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What the Figures Show

Most of the statistics of production for castings for 1957 are available, and, with the exception of iron castings, make good reading. First of all, in the " plus " range, comes steel castings with an output of 335,100 tons—a figure which has not been exceeded since 1944, when steelfounders were coping with war-time production. The further 1 per cent. rise which this tonnage represents is especially good, as the 1956 figure itself showed a 6 per cent. increase over 1955. The production of copper-base castings last year, at 77,148 tons, was also a post-war record, being just about 100 tons higher than in 1956. These figures follow the same trend as those for steel castings, with a 7 per cent. rise in 1956 over 1955 and a negligible rise the following year. The official figures from the Ministry of Supply for the production of aluminium-alloy castings in 1957 are not available at the time of writing, but our estimate is that the final total will be of the order of 79,000 tons, or only about 400 tons higher than in 1956, definitely not so satisfactory as the 1955 production, which was over 90,000 tons. Our estimate of the 1957 output of magnesium-base castings is 2,555 tons, which shows an alarming reduction over the previous year. In fact, one has to go back to 1947 to reach a lower figure, starting at 1956 and going back another three years, the annual totals are 3,384, 4,557, 4,443 and 4,089 tons. To revert to the aluminium-alloy castings, the figures for the first 11 months were 19,414 tons of sand-cast material, 38,388 tons as gravity-die and 14,574 tons of pressure-die-cast components. During the year, it would appear that die-castings production has expanded more quickly than the sand-cast variety.

The production of iron castings receded from the 1956 figure of 3,899,170 tons to 3,715,100 tons last year. Very fortunately, it is considered out-of-date to sell castings by weight and it would occasion no surprise to us if someone stated the value of the output last year had not suffered any fall, because there was an increase in highly-priced automobile castings and a decrease in pipe production. The statistics printed elsewhere in the JOURNAL detail the production by sections of the industry, which as is to be expected, reveal factors which, happily, do not affect all divisions equally. The reduction recorded is of the order of 5 per cent., but it should be remembered that 10 per cent. either way represents either a boom or a slump for a section, but not necessarily for the whole industry.

Probably the most significant figures for the foundry industry are those relating to the sales of foundry plant, for these reflect the confidence being placed in the future. It is pleasing to record that from figures supplied by the Board of Trade, the equipment industry, at £5,454,000, furnished half-a-million pounds more worth of plant to the foundry industry than they did the year before; practically the whole of this increase was due to orders placed in the home country. Exports did, however, top the million mark—possibly a record, but the statistics have only been gathered during the last two years. The figures do not include conveyors and other items of mechanization. Though we have strongly protested, a decision has been made by the Board of Trade to discontinue this statistical service to the foundry-equipment industry.

ABBF Area Meeting

Yorkshire

Members of the Association of Bronze & Brass Founders in the Yorkshire area met for an informal meeting at the Great Northern Hotel, Leeds, on January 23. This provided an opportunity for the president, Mr. P. B. Higgins, to inform members about the European Committee of Foundry Associations (whose meeting in Amsterdam he attended last October), the importance of this in connection with the European Free Trade Area and the need which it implied for British foundry associations to work together. With this in mind, he reported that he had called together the heads of foundry and allied associations from which it was expected liaison would evolve. This would prove valuable in dealing with the many problems with which they were faced, notably those arising from recent and projected legislation.

Information was given on action taken in respect of the Clean Air and Thermal Insulation Acts, and on progress made by the Advisory Committee on Conditions in Non-Ferrous foundries. An outline was given of the revisions proposed to alloys in specification BS. 1400:1948, and attention was drawn to the work of the Technical Advisory and Research Group, which, by collaboration with the British Non-Ferrous Metals Research Association, was able to instigate work both of immediate and long-range value to the industry as well as providing a technical reference and advisory service. The meeting closed with a talk on the recently published "Survey of Furnaces for Melting Copper Alloys."

Institute of Metals

Golden Jubilee Meeting

From April 28 to May 2, the Institute of Metals will, at the Spring meeting to be held in London, celebrate its Golden Jubilee. Very appropriately, the meeting opens with a lecture by Professor R. S. Hutton, M.A., D.SC., an original member. It is to be held at the Royal Institution, Albemarle Street, and will be followed by a social function. Next day, Tuesday, April 29, there will be the usual annual general meeting when the new president, Marshal of the Royal Air Force, the Rt. Hon. the Lord Tedder, G.C.B., D.C.L., LL.D., will be inducted into the chair. This meeting is to be held at Church House, Great Smith Street, Westminster, S.W.1. The proceedings will terminate with a cocktail party. In the afternoon, Professor A. G. Quarrell, D.SC., PH.D., will deliver a talk on "Fifty Years of Metallurgical Science," and in the evening there is to be a reception in the Livery Hall of the Worshipful Company of Fishmongers.

The days of Wednesday and Thursday are to be devoted to the discussion of papers, but on Thursday evening there is to be held at Grosvenor House, the Golden Jubilee banquet, at which the Rt. Hon. the Lord Hailsham, Lord President of the Council, is to be the principal guest.

Friday, May 2, has been reserved for all-day works visits and a number of interesting non-ferrous foundries have been included in the programme. The organizers are to be congratulated on assembling an excellent programme well worthy of the important event it celebrates.

MODERN ENGINEERING MACHINE TOOLS, LIMITED—Mr. H. K. Snell and Major-Gen. W. A. Lord have been elected to the board.

Llanelly Site Claimed for Steel Mill

Twelve west Wales local authorities, who claim that the £200,000,000 integrated steel mill which Richard Thomas & Baldwins, Limited, proposes to build, should be sited in the Llanelly area, put their case last week to a special panel of 10 appointed by the Council for Wales and Monmouthshire to investigate the sociological effects and causes of unemployment in South Wales.

Mr. Selwyn Samuel, town clerk of Llanelly and spokesman for the working committee for the 12 towns, has stated that there is an urgent necessity to arrest migration.

More than 8,000 tinplate and steel workers are now unemployed in west South Wales. Llanelly, which was built around its steel and tinplate works, most of which have now closed, has over 2,000 persons unemployed. It is expected that the Government will shortly announce its decision on the siting of the new steel mill, and that it will favour an early start on the project.

Latest Foundry Statistics

Foundry Equipment. This is the last time that these figures will be available to industry, as the Board of Trade has decided to discontinue their collection. They cover the last quarter of the year (October to December, 1957) and show that the total business done (including merchanting) was £1,439,000, of which £227,000 was for export. The total business done (with the exports between brackets) in the various sections was:—Sand-preparing machines (*i.e.* mills, disintegrators, etc.) £327,000 (£46,000); moulding machines and moulding boxes £326,000 (£85,000); shot-blast plant £361,000 (£60.000); melting equipment (including ladles) £89,000 (£9,000); core-making machines, plant and accessories £39,000 (£6,000) and other equipment, including chaplets and studs but excluding mechanical-handling plant or mechanization and materials such as abrasives, etc., £296,000 (£24,000).

British Standards Institution

A new British Standard, B.S. 2955:1958, defines a number of selected terms applicable to metallic and non-metallic powders. Following a definition of powder (arbitrarily decided upon as "discrete particles of dry material of size less than 1,000 microns maximum dimension") are sections containing terms associated with:—Types of powder; particle size; particle shape; powder properties, and powder processing. The two appendices to the standard deal with "Mean diameters of particulate systems" and "Calculation of Stokes's diameter" respectively. Copies of this standard may be obtained from the British Standards Institution, sales branch, 2, Park Street, London, W.1; price 4s. 6d.

Clean Air Act

The Department of Health for Scotland, which is responsible for administering the Clean Air Act in that country, has now arranged that the public enquiry into the application of the Act (which it announced as long ago as November, 1956) will in fact take place on April 8 this year. It will be held in Edinburgh and will be for the purpose of scheduling certain industrial processes under the "Alkali, etc., Works (Scotland) Act, 1951." It is understood that a number of submissions have been made for the scheduling of foundry processes.

Foundry Goggles . . . FIRST REPORT OF THE JOINT ADVISORY SUB-COMMITTEE*

When the Joint Advisory Committee on Foundry Goggles, appointed by Sir George Barnett, issued its Report towards the end of last year, it included the following clause: "It is therefore suggested that the necessary publicity should be given to this Report in order to facilitate and expedite the practical application of our recommendations." As the organ of the foundry industry of this country, this JOURNAL *has now been granted the privilege of presenting almost in full the Report and its Appendices.† It must be made clear, however, that neither the optical qualities of the materials recommended as giving adequate physical protection when used as goggle lenses, nor specific recommendations for goggle frames, etc., have yet been covered, and these subjects await further clarification from the Committee. What is certain is that the interim conclusions are of such a revolutionary nature that their dissemination for consideration by the foundry industry at large is very desirable. Measures designed to increase safe-working practices must always be treated as matters of urgency. No apologies are made for reporting this work in the* JOURNAL *so fully, even to the extent of recording details of equipment and individual tests. Only by so doing can the severity of the tests be gauged and comparisons made by other research workers in the same field. If as a result of this work (and much more work in hand) the eyesight of but one foundryman is saved then it has all been most worthwhile.*

PREFACE

The following extract from *Hansard* of the Parliamentary debate on November 20, 1957, forms an important preface to the publication of this Report because it makes clear the interim nature of the statements made and emphasizes the fact that much more work is desirable:—

MR. FRANK ALLAUN asked the Minister of Labour when the Report of the Joint Advisory Committee on Foundry Goggles would be published.

THE PARLIAMENTARY SECRETARY TO THE MINISTRY OF LABOUR AND NATIONAL SERVICE (MR. ROBERT CARR) said it was proposed to publish the Report when research by the Committee permitted a more comprehensive and authoritative advice than was at that time possible. Meanwhile, copies of the Report were being sent to all the organizations interested in this problem.

MR. ALLAUN asked if the Parliamentary Secretary realized that Trade Union representatives were concerned and impatient about the delay? Could not the Report be published before Christmas?

MR. CARR assured Mr. Allaun that his Ministry was anxious to have the Report published, but whereas the Committee came to the general conclusion that plastic was to be preferred to glass for protective goggles, further research work was required for specific advice to be given about the form of plastic. Before a final report was published, they wanted to have that specific advice.

MAIN REPORT

The first report of the Joint Advisory Committee on foundry goggles (membership quoted at the following page of this report) was made in August, 1957, and addressed to Sir George Barnett, then H.M. Chief Inspector of Factories, as follows:—

In 1955 you invited representatives of the Employers' Federations, the Trade Unions, the British Standards Institution and certain research organizations and universities to form a committee to advise you on some aspects of the use of goggles in the founding industry. The Committee held its first meeting on October 20, 1955, when you gave to it the following terms of reference:—

> *To advise H.M. Chief Inspector of Factories as to the most efficient type of personal eye-protection to be worn by a foundry worker at risk from molten metal.*

During the course of our work we have examined an analysis of all the eye accidents that occurred in the founding industry in 1954 and 1956. We have visited three foundries, we have searched the literature for work done in this country and overseas, we have held discussions with interested individuals, firms and organizations, and have initiated and carried out research on certain aspects of the problem presented to us.

Apart from one very comprehensive American report‡ we found no published work to assist us and we decided to do our own experimental work. We set up a sub-committee for this purpose, consisting of Mr. G. T. Hyslop, Mr. A. W. Bushell and Mr. W. B. Lawrie and gave them powers to co-opt additional members. This sub-committee has now completed a large amount of work and its results are presented in Appendices I and II which represent their first report. The work has not yet been completed, but some definite conclusions have been reached. Our terms of reference refer to "a foundry worker at risk from molten metal," but the sub-committee pointed out that a molten-metal splash may solidify as it passes through space so that the foundry worker may be struck by hot solid metal even though he may be properly said to be "at risk from molten metal." It has in the past been customary to test goggles by means of "cold tests," and in order to correlate their molten and hot-metal test results with existing test results the

* The membership of the Committee is quoted overleaf.

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‡ Final Report on the American Society of Safety Engineers' Research Project—Plastic Eye Protectors.

Foundry Goggles—First Report

sub-committee has done some work on cold testing. There has, therefore, been some divergence from the strict letter of our terms of reference, but only so as to ensure that any recommended form of eye protection would, in fact, protect "a foundry worker at risk from molten metal."

The sub-committee has dealt both with the strength of the materials of which lenses may be made and especially with their resistance to penetration by molten and hot metal. There has not yet been time to deal fully with many other matters which are involved in the provision of suitable eye protection and this report deals mainly with the physical resistance to penetration of certain materials which might be suitable for use as eye protectors. It does not deal with other aspects of the problem such as the optical properties of these materials and the correct design of goggles.

In April, 1956, you issued at our request a letter to certain interested organizations in which you stated our views at that date. The results of the subsequent experimental work, including exacting tests on various materials carried out by the sub-committee, together with certain other results obtained from different sources have altered our views appreciably.

Tests of Materials

The sub-committee has tested specimens of laminated-glass lenses and toughened-glass lenses, in addition to a range of plastics materials, including one type of laminated-plastic lens. After they had devised and made a suitable testing machine, the sub-committee tested the various lenses by projecting molten metal against them. In this series of tests they used varying weights of steel at 1,600 deg. C., iron at 1,450 deg. C., phosphor-bronze at 1,150 deg. C., gunmetal at 1,150 deg. C, aluminium at 750 deg. C and white-metal at 500 deg. C. In all cases the plastics were, under the conditions of test, superior to either toughened or laminated glass. The sub-committee also used both hot and cold solid projectiles on the machine and consistently found that the plastics materials were superior. The sub-committee developed a second testing machine in which a needle was used to determine the resistance of the goggle lenses to penetration. Once again in all cases the plastics materials were superior. Finally, the sub-committee did some further tests on the plastics materials in an effort to determine the ease with which they might burn if they were struck by a red-hot piece of metal at such a velocity that it was embedded in the lens. In this series of tests some of the plastics materials were better than others.

Certain high-speed ballistic tests have also been brought to the Committee's notice. In these tests the lenses were struck by a projectile which weighed about one gm. and which was made in the form of a cube. At the moment of impact, the projectile —which was fired from a shotgun—was moving at velocities between 800 and 1,000 ft. per second. The results of the tests indicated that a laminated-plastic lens withstood the missile at speeds up to 850 ft. per sec. but that toughened or laminated glass failed at much lower velocities.

Interpretations of Test Results

In the earlier recommendation on which you based the letter to which reference has been made, we unanimously rejected the use of wire-mesh in any form other than as side pieces, because we were satisfied that high-velocity molten metal meeting it directly could penetrate it. Because of this weakness, wire mesh should not be used at all as eye protection against molten metal.

The sub-committee's work has shown that the earlier recommendation as regards laminated and toughened glass was not well found and that other materials give better protection against molten metal. We know now that when laminated glass is struck on the front lens and cracked, small splinters often fly off the back lens and as the back lens is the one that is adjacent to the eye of the wearer, this fact does not give us much confidence in the lens. We know, too, that while laminated and toughened glass will give protection against light sparks and splashes, the plastics materials tested, if

Composition of the Joint Advisory Committee on Foundry Goggles

Mr. R. Bramley-Harker, H.M. Deputy Chief Inspector of Factories (chairman).
Mr. R. Berry, British Standards Institution.
Mr. A. W. Bushell, Council of Iron Foundry Associations.
Professor G. P. Crowden, O.B.E., T.D., London School of Hygiene and Tropical Medicine.
Mr. J. Gardner, Amalgamated Union of Foundry Workers.
Mr. J. Higham, National Union of Stove, Grate and General Metal Workers.
Mr. G. T. Hyslop, Phosphor Bronze Company, Limited.
Mr. W. B. Lawrie, M.B.E., H.M. Engineering Inspector of Factories.
Dr. A. I. G. McLaughlin, H.M. Deputy Senior Medical Inspector of Factories.
Mr. H. V. Shelton, National Light Castings Ironfounders Federation.
Dr. A. H. Sully, British Steel Castings Research Association.
Mr. T. A. Swinden, Engineering and Allied Employers' National Federation.
Mr. H. C. Weston, Institute of Ophthalmology.
Mr. W. A. Attwood, H.M. Engineering Inspector of Factories (secretary).

NOTES.—*Mr. Bramley-Harker succeeded Mr. T. W. McCullough in June,* 1956; *Dr. A. H. Sully succeeded Dr. R. J. Sarjant in May,* 1956; *and Mr. G. T. Hyslop resigned in March,* 1957.

of adequate thickness, will protect against heavy splashes of molten metal. These plastics are, therefore, so superior to glass in protection against molten metal that we no longer consider either laminated or toughened glass to be the most efficient material for this purpose. The reasons for these conclusions have been fully set out by the sub-committee in the report which forms Appendices I and II. We know that some plastics give better results than others, that some burn and some do not, that some warp easily under the influence of heat and that many of the plastics are soft enough to be easily scratched.

Other Considerations

We have not investigated very closely the optical properties of the various plastics, nor have we examined in any detail the problem of providing prescription lenses or the manufacturing difficulties that might be involved in the use of plastics lenses. But notwithstanding the incomplete nature of the investigations it is felt that some specific recommendations can be made. Having discovered that some materials will afford satisfactory resistance to molten metal and other projectiles, the next part of the problem was to decide what standard of protection should be aimed at, that is, complete eye enclosure or something less, and then to decide what type or types of equipment will provide this standard of protection.

Closely allied to this part of the problem is the difficulty in getting workmen to make proper use of the equipment provided. There can be no doubt that this difficulty has been due to some extent to the provision of unsuitable and unsatisfactory equipment. The frequent complaints about discomfort and misting-up are by no means unfounded.

In seeking a practical solution the Committee has come to the conclusion that in order to get the men to wear the equipment it might be necessary to provide a device which does not give complete eye enclosure but which will meet the requirements of Regulation 8 (1) (*c*) Iron and Steel Foundries Regulations, 1953, for it does not seem that absolute enclosure is thereby necessarily required. It has been established that many men will wear a spectacle type of eye protection much more readily than goggles or other types which given complete enclosure but many of which restrict the field of view, and, due to inadequate ventilation are very liable to become misted-up. Spectacles provide a very high degree of protection particularly when side wings are added. These side wings should be of non-perforated transparent plastics material. Examination of the reports of investigation of accidents to eyes which have occurred in foundries due to molten metal confirms that a large proportion would have been prevented if the injured person had been wearing spectacle-type protection. The sub-committee has pointed out one serious drawback to the use of metal in conjunction with plastics materials in that molten metal tends to adhere to the solid metal and so damage the adjoining plastics material. This disadvantage can probably be overcome by coating metal frames and ear-pieces with plastic.

The importance of correct fitting must be stressed, and it is of even greater importance when complete eye enclosure is not provided. If the spectacle type becomes a standard which is worn by the workers, then the approach to ideal protection will be enhanced by individual fitting of the spectacles. Moreover, comfort in wear (or the lack of it) has been the major cause of non-co-operation by employees; individual fittings will do much to meet such objections.

In order to secure proper compliance with Regulation 8(1)(c) of the Iron and Steel Regulations, 1953, it is necessary that there should be the fullest co-operation of both employers and workmen; we are satisfied that such co-operation will be greatly facilitated by the adoption of our recommendations in the next paragraph.

It is therefore suggested that the necessary publicity should be given to this report in order to facilitate and expedite the practical application of our recommendations.

Recommendations

The Committee's recommendations are briefly that:—

(i) Plastics materials as a class give the most effective protection against molten metal and within this class laminated-plastic lenses are superior to any other. We, therefore, recommend that their development should be encouraged and expedited.

(ii) The spectacle type with side wings is one practical form of eye protection likely to achieve a substantial reduction in accidents, the individual fitting of such eye protection being a necessary requirement in achieving this object.

(iii) It is, however, intended that where goggles and eye-shields providing complete enclosure of the eyes are at present in use, such use should continue and, indeed, the use should be extended where conditions of work allow.

(iv) There are some types of eye protection in use at the present time which do not conform to these standards, but they should not be discarded until better protection is available.

(v) There will be interpretations (and we know of some at present) of these recommendations which because of inferior workmanship, manufacture and unsuitable materials used will not meet the high standard of durability which is necessary under the particular conditions obtaining in foundries. It is suggested, therefore, that there should be an advisory panel to give, say, a hallmark to the products which makers offer to the industry. This panel could well be chosen from members of the optical associations and the British Standards Institution and meet under the aegis of H.M. Chief Inspector of Factories.

(vi) In paragraph (5), we referred to the letter which was circulated to the foundry industry, with certain recommendations based on some preliminary information. The Committee regrets any misapprehensions which may have been

caused by this letter, and suggests that the earliest opportunity should be taken to correct them.

Acknowledgments

The Committee wishes to record its thanks for the help it has received, particularly on the question of correct fitting referred to in a previous paragraph from the British Optical Association, the Guild of British Dispensing Opticians, the Association of Wholesale Manufacturing Opticians and the Joint Committee of Ophthalmic Opticians, and is particularly grateful for an offer of assistance from these bodies in establishing a nation-wide service which will ensure correct initial fitting and subsequent maintenance. A committee has been formed by these associations to consider the best method of putting this into effect and its recommendations can be expected shortly.

Thanks are also due for help and advice received from employers' federations, trade unions and many individual firms, with particular thanks to the Midland Motor Cylinder Company, Limited, for providing the facilities for most of the tests carried out by the sub-committee.

The Committee also wishes to record its great appreciation of the work of the sub-committee which by its thorough nature gave considerable assistance in enabling the main Committee to present this Report at so early a stage. The work of the Committee has been greatly facilitated by the able help of the secretary, Mr. W. A. Attwood.

[The Report is duly signed by its chairman, serving members and secretary.]

APPENDIX I

First Report of the Sub-Committee of The Joint Advisory Committee on Foundry Goggles.*

Introduction

The protection of the eyes of foundry workers by means of goggles, spectacles or visors involves ophthalmological considerations, questions of comfort and other matters which have not been considered. We have dealt only with the strength of the materials of which lenses may be made and especially with their resistance to penetration by molten and solid metal projectiles. In most instances we have tested lenses only, as we have not had time to construct suitable machines for the testing of complete goggles. Neither have we been able to test every make of material in the time available. We have, however, tested toughened glass, laminated glass, Perspex (methyl methacrylate), laminated Perspex, an allyl resin, Cobex (a co-polymer which is essentially a rigid polyvinyl chloride) and Bexoid (a cellulose acetate), together with sundry other acetate specimens which were taken from goggles and visors which were found in use in the industry.

* The sub-committee comprised Mr. A. W. Bushell, Mr. G. T. Hyslop (resigned March, 1957), and Mr. W. B. Lawrie, M.B.E., M.Sc., F.R.M.S., A.I.M. Its report was addressed to the chairman of the main Committee.

It was considered that the physical properties of any material that might be used for eye protection should be determined if they were not already known. The only British information available appeared to be the British Standard 2092: 1954, which specified an impact test and in addition to this the final report of the American Society of Safety Engineers on Plastics Eye Protectors was examined. It was decided that more precise details were needed on the behaviour of lenses under impact from molten metals and so efforts were concentrated in the first instance on this aspect of the matter. Once this had been done we thought that the other physical properties as shown by the normal tensile test, compression test and the like could be obtained from the makers of the various materials. Even if this latter information was not available it was assumed that it could be obtained readily enough.

In addition to the physical properties, we consider that chemical properties as they affect the durability of lenses in foundry conditions and optical properties such as light transmission, internal reflection, the absorption of infra-red radiation and so forth should also be examined in order to be able to select the best material for the lenses. It is believed, however, that the question of resistance to penetration by molten metal is by far the most important and must be answered first. Materials which do not offer protection in this sense should not be used for goggle lenses whatever their optical properties, because it is manifestly useless (for example) to discuss the effect of infra-red radiation on the eyes if they cannot first be protected from physical destruction by molten metal which has penetrated the goggle lens. As a first step, therefore, the sub-committee confined themselves entirely to the discovery of materials which would not be penetrated by molten metal and this first report deals only with this single aspect of the matter.

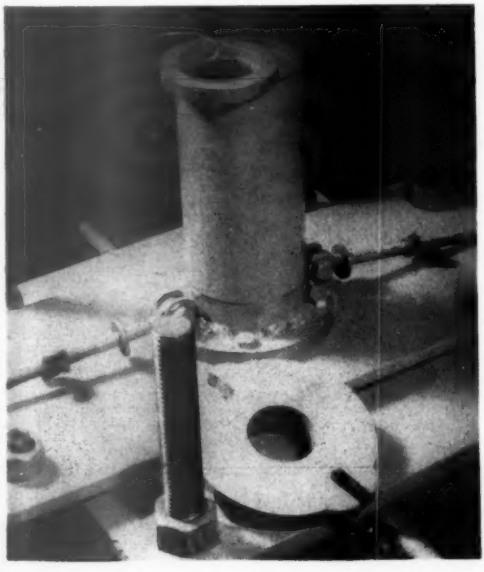
The small amount of published work on the subject did not indicate suitable methods of testing: the first necessity therefore was to devise a testing machine. Preliminary discussions centred around the severity of the test—we think it impossible to define "average risk." Very occasionally moulds explode after being cast, when the total weight of metal in the mould may be thrown violently into the air. This may represent many tons of metal but on the other hand very small splashes occur frequently, and the weight of metal in these splashes may be so small as to require a chemical balance to determine it. We cannot, therefore, suggest an average weight for splashes of molten metal, nor can we suggest an average velocity for splashes moving through the air. It might be possible to determine specific velocities in particular cases by means of a cinematograph camera, but it was decided that this was not sufficiently important to occupy the sub-committee's time in the early stages of the work.

Quite apart from metal splashes, sparks constitute a danger. These may consist of metal which is in process of oxidation as it flies through the air and at the end of its trajectory a spark may con-

FIG. 1.—*Spring-loaded device for ejection testing of goggle lenses.*

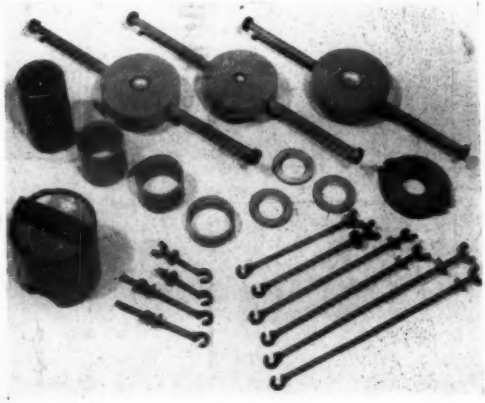
FIG. 2.—*Other details of the testing machine: Ejector heads, retaining rings, spacing rings, clamps and guard.*

FIG. 3.—*Close-up of the testing device, showing the method of mounting the specimen above the stop platform.*



tain more oxide than metal. It was thought that this matter of chemical composition might have some influence on the material that should be used for goggles, and later work has confirmed this view. The diversity of metals that are melted and the diversity of casting techniques emphasized the impossibility of defining "average risk." One further difficulty presented itself. Even if a splash of metal leaves its point of origin in the molten state, it is changing temperature continuously as it passes through the atmosphere. Normally it will be cooling, but if the oxidation process be exothermic it will generate heat and the temperature will rise. Goggles may therefore be struck either by molten-metal or by hot solid metal. In view of all these considerations it was agreed that no attempt should be made to try to devise tests that purported to simulate any such hypothetical quantity as "average risk."

One can only define the degree of protection that it required of goggles by stating that if a man



survives an accident then his goggles should have been good enough to preserve his eyes. This is obviously an ideal which may or may not be possible. It was concluded, however, that the only proper way to test was to test to destruction and this is what the sub-committe tried to do. We have not in fact succeeded in penetrating most of the plastic lenses tested; indeed, we have not yet succeeded in even marking some of them, but we still think that tests should be devised and carried out, by means of which all the possible materials can be penetrated so that they can be arranged in order of merit and also know by how much the best material exceeds the worst in its resistance to penetration. This would indicate something like an empirical factor of safety in known conditions.

It was decided, therefore, that the test machine should be capable of penetrating all the materials tested, and although the sub-committee have not yet succeeded in obtaining so severe a test the members still think that this should be done. It was also decided that the machine should be so

designed that it could be calibrated. Appreciating that accurate results might not be obtained easily, it was thought that reasonably good approximations of the energy that lenses would absorb without being penetrated would be better than purely empirical results.

Empirical Tests

A few practical tests were done in the early stages of the work on a centrifugal casting machine in which phosphor-bronze was being cast at about 1,500 deg. C. The mould was rotating about a horizontal axis and it was slightly over-filled with the metal so that there was a definite splash at the front opening. Plastic visors and goggles were

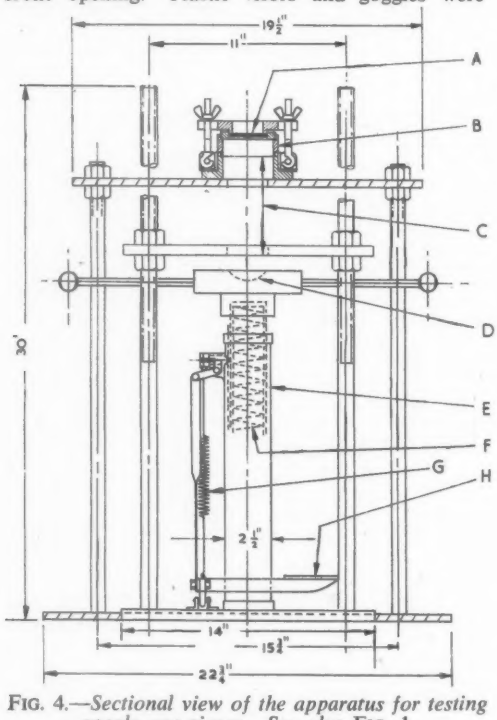


FIG. 4.—*Sectional view of the apparatus for testing goggle eye-pieces. See also* FIG. 1.

Key: A, test lens in position; B, distance-piece; C, minimum test distance 3 in. (this dimension can be increased by the addition of distance-pieces to a maximum of 5 in.); D, ejection head (dished ⅛ in. deep); E, ejection cylinder; F, ejection spring; G, pedal return spring; and H, release pedal.

mounted on a white card and held in the splash in close proximity to the rotating mould. Some of these plastics materials were penetrated by the flying particles but it was quite impossible to calculate the momentum of these particles, or to know whether they were fluid or solid at the moment of penetration. Later work implied that the particles which penetrated the plastics were in the solid state, but this has not yet been proved and solid penetration tests are considered essential to supplement the tests with molten metal tests.

Centrifugal Testing Machine

A centrifugal testing machine was then constructed in which the molten metal dropped from a small crucible on to a rotating table. The specimens to be tested were mounted in a circle around the table so that the molten metal thrown from the table impinged upon them. A few tests were carried out with this machine using different non-ferrous metals

TABLE 1.—*Tests of "Cobex" Plastic 50-mm. diameter Specimens with Gunmetal.**

Projectile: Admiralty gunmetal, copper 88, tin 10, and zinc 2 per cent.; temperature: 1,150 ± 20 deg. C.; maximum spring tension; height of stop-platform 24 in.; specimen location: 3-in. above stop platform, and weight of molten metal: 143 gm.

Specimen thickness, in.	Results.
0.03	No penetration; specimen melted at edges and somewhat darkened probably owing to delay in removing it after test
0.04	No penetration; no adhesion of molten metal to specimen; overall darkening
0.05	No penetration; no adhesion of molten metal to specimen; overall darkening
0.06	No penetration; slight burning at edge of specimen as metal adhered to holding ring; overall darkening

* Similar sets of results for the plastics lenses when using projectiles of molten white-metal, pure aluminium, phosphor-bronze, and stainless steel are recorded in the sub-committee's original report. In no case was there penetration of a lens even with thicknesses as small as 0.03 in.

TABLE 2.—*Tests with Laminated-glass Lenses and Various Molten-metal Projectiles.*

Maximum spring tension; height of stop-platform: 24 in.; specimen location: 3-in. above stop-platform.

Projectile.	Weight, gm.	Temperature, deg. C.	Results.
White-metal	150	500 ± 20	No penetration; glass cracked and large proportion of metal adhered to glass
Pure aluminium	40	750 ± 20	No penetration; surface cracked; metal adhered to glass
Admiralty gunmetal	143	1,150 ± 20	No penetration; both glass surfaces cracked; some very small splinters broke away from surface that had not been struck; large piece of gunmetal adhered to impact surface of specimen

TABLE 3.—*Tests with Toughened-glass Lenses and Molten Aluminium and Gunmetal Projectiles.*

Maximum spring tension; height of stop-platform: 24 in.; specimen location: 3-in. above stop-platform.

Projectile.	Weight, gm.	Temperature, deg. C.	Results.
Pure aluminium	40	750 ± 20	Specimen completely disintegrated; large globule of metal penetrated glass into protective canister behind; some glass particles dropped back into into molten metal after test
Admiralty gunmetal	139	1,150 ± 20	Overall shattering and splintering; glass fell into molten metal after test; some glass splinters were collected in plasticine mounted ⅛ in. behind the lens; metal also penetrated lens

and in no case was a plastics material penetrated by the metal. It was noticed, however, that some metals adhered to the plastics specimens and some did not. It appeared therefore that different metals reacted differently to certain plastics. The machine was convenient enough in operation but its use was discontinued because there was no means of knowing whether the metal was solid or fluid at the point whether the metal was solid or fluid at the point of impact with the specimen, and also because it was almost impossible to calculate the amount of energy in the flying particle when it struck the specimen.

was mounted at one of three different distances above the stop platform. Eight tests were made using glass lenses. It was found that small ball-bearing projectiles did not damage either toughened or laminated glass. The size of the projectile was therefore increased until the specimens could be broken by means of a section of mild steel weighing 212 gm. The laminated-glass lenses, both coloured and plain, were cracked on both sides when mounted in each location stage 1, 2 and 3 and the toughened-glass specimen was completely shattered in location stage 1. Only one toughened-glass specimen was used, as this was the sole example

TABLE 4.—*Test Machine Velocity and Projectile Momentum, using Steel Ball Projectiles.*
For the purpose of determining the velocity (V) and momentum (M) to which specimens were being subjected in the machine, simple calculations were used which ignored those elements and conditions which would normally need to be taken into account.
Velocity = $\sqrt{2g}$ (height of projectile).
The velocity at a *given height* above the datum is obtained by using the above formula and subtracting the *given height* from the height of projection.

Dia. of steel ball in.	Weight of ball, gm.	Total Height of projection, in.	Velocity (V.) in ft. per sec. and Momentum (M.) in gm./ft. per sec.									
			3-in. stop.		4-in. stop.		5-in. stop.		6-in. stop.		9-in. stop.	
			V.	M.	V.	M.	V.	M.	V.	M.	V.	M.
½	1	20	9.5516	9.5516	9.2663	9.2663	8.9723	8.9723	8.6659	8.6659	7.6833	7.6833
⅝	2	20	9.5516	19.1032	9.2663	18.5326	8.9723	17.9446	8.6659	17.3318	7.6833	15.3666
¾	3	20	9.5516	28.6548	9.2663	27.7989	8.9723	26.9169	8.6659	25.9977	7.6833	23.0499
1	8	20	9.6908	76.4128	9.41	74.1304	9.1205	71.7784	8.8215	69.3277	7.8560	61.4664
1½	28	20½	9.6908	267.4448	9.41	259.4564	9.1205	251.2244	8.8215	242.6452	7.8560	215.1324
1¾	45	20½	9.6908	429.8220	9.41	416.9835	9.1205	403.7535	8.8215	389.9655	7.8560	345.7485
1⅞	55	20½	9.6908	525.3380	9.41	509.6465	9.1205	493.4765	8.8215	476.6245	7.8560	422.5815
2	67	20½	9.6908	639.9572	9.41	620.8421	9.1205	601.1441	8.8215	580.6153	7.8560	514.7811
2⅛	80	20½	9.6908	764.1280	9.41	741.3040	9.1205	717.7840	8.8215	693.2720	7.8560	614.6640

Low-velocity Ballistic Tests

A testing machine (Figs. 1 to 4) was constructed in which a spring-loaded piston was fitted with an ejector head. This head was dished to a depth of half an inch to accommodate a solid or a fluid projectile. A fixed stop platform was mounted above the head and provided with a central opening large enough to allow the projectile to pass through. The specimen itself was mounted above this opening. In use, the spring is compressed and the liquid or solid projectile is placed in the dish in the ejector head. On releasing a foot catch the spring drives the ejector head vertically upwards until it strikes the stop platform. This stops the head but the projectile is thrown through the central opening in the stop platform to strike the specimen mounted above it. A sheet-metal guard is placed over the specimen to collect the molten metal and any fragments that might fly from the broken specimen.

available at the time. These conclusions led to a decision to extend the thread on the stop-platform control-rods, so that the platform itself could be lowered to reduce the travel of the projectile ejector head before it made contact with the underside of the stop platform.

Tests with molten metal were then made with the modified machine and in order to make first comparisons the conditions were similar to those used in the first eight tests, apart from the modification of the machine itself. Specimens were mounted in the three location stages in turn and the maximum spring-tension was applied, the stop platform remaining at 22½ in. above the base. Ten specimens were tested with molten iron at 1,400 ± 20 deg. C. as the projected material with the somewhat surprising result that laminated coloured glass and toughened glass were completely disintegrated in specimen-location stage 3 by a charge of about

TABLE 5.—*Test Machine Velocity (V.) and Charge Momentum (M.) when using Solidified Cast-iron Charges as Projectiles.*
Maximum spring tension; height of stop-platform: 24 in.

Size of head.	Weight of average charge, gm.	Height of projection, in.	Velocities (V.) in (ft. per sec.) and Momentum (M.) in gm./ft. per sec.									
			3-in. stop.		4-in. stop.		5-in. stop.		6-in. stop.		9-in. stop.	
			V.	M.	V.	M.	V.	M.	V.	M.	V.	M.
Small	35	18	8.9723	314.03	8.6679	303.38	8.3526	292.34	8.0249	280.87	6.9499	243.25
Medium	95	18	8.9723	852.37	8.6679	823.45	8.3526	793.50	8.0249	762.37	6.9499	660.24
Large	145	21	9.8286	1,425.15	9.5516	1,384.98	9.2663	1,343.61	8.9723	1,300.98	8.0249	1,163.61

First Series

The first series of tests was made largely to assess the merits of the machine itself. The maximum spring-tension was used and the stop platform was fixed at 22½ in. above the base. Each specimen

109 gm. of iron. In view of these results, the stop platform was raised to 24 in. above the base. The last specimens continued to be completely shattered in spite of efforts to reduce the charge of molten metal.

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The first series of tests therefore indicated that certain plastics lens specimens would withstand reduced charges of metal, but that both laminated- and toughened-glass specimens were incapable of withstanding the impact of these charges without cracking badly or shattering completely. It was clear, however, that the machine itself required certain modifications before stable results could be obtained, and this was taken as the next stage in the work.

TABLE 6.—*Tests on Toughened-glass Lenses, using Solid Projectiles and Maximum Spring Tension (Height of Stop-platform: 24 in.).*

Dia. of steel ball, in.	Height of specimen above stop-platform (in.).				
	3	4	5	6	9
¼	No effect	No effect	No effect	No effect	No effect
5/16	,,	,,	,,	,,	,,
⅜	,,	,,	,,	,,	,,
7/16	,,	,,	,,	,,	,,
½	,,	,,	,,	,,	,,
9/16	,,	,,	,,	,,	,,
⅝	,, (*a*)	,,	,,	,,	,,
1	,, (*b*)	,, (*c*)	,, (*c*)	Completely shattered	,, (*d*)
1 1/16	Completely shattered	Completely shattered	Completely shattered	Completely shattered	No effect

Notes.—(*a*) In one instance a specimen withstood this blow, but completely disintegrated about one minute later. (*b*) Six repeated shots at this stage had no effect on three glasses although three were completely shattered. (*c*) One glass shattered at the third blow; another glass withstood four blows, and a third glass was shattered by the second blow. (*d*) One glass shattered at first blow; five successive repeat blows failed to shatter another glass. (*e*) One glass was shattered by the third blow.

Second Series

After the first series of tests were completed, a second ejector-head was made which held a charge of approximately 95 gm. of molten iron and a fourth specimen-location stage was built above the three already provided. In the second series, ten tests were made using molten iron as the projectile and this second series confirmed the first. The plastics withstood the impact of the molten metal, the toughened glass was completely shattered and the laminated glass was very severely cracked and in some cases penetrated and shattered. Both glasses were badly cracked in the laminated lenses and it was noticed that the top glass of the lens, that is, the one that would be nearest a man's eye when the lens was in use, splintered besides cracking. Close examination showed that splinters of glass had broken away from the lens. This phenomenon was seen in many later tests and it undermined the sub-committee's confidence in the suitability of laminated-glass lenses for goggles.

TABLE 7.—*Tests of Laminated-glass Lenses, using Solid Projectiles and Maximum Spring Tension (Height of Stop-platform 24 in.).*

Dia. of steel ball, in.	Height of specimen above stop-platform (in.).				
	3 in.	4 in.	5 in.	6 in.	9 in.
¼	No effect	No effect	No effect	No effect	No effect
5/16	,,	,,	,,	,,	,,
⅜	,,	,,	,,	,,	,,
7/16	,,	,,	,,	,,	,,
½	,, (*a*)	,, (*c*)	,, (*a*)	,, (*a*)	,, (*d*)
9/16	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)
⅝	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)
1	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)	,, (*d*)
1 1/16	,, (*b*)	,, (*a*)	,, (*a*)	,, (*a*)	,, (*a*)

Notes.—(*a*) Both glasses cracked; minute splinters came off the top glass (*i.e.* the glass which would be adjacent to the eye in a pair of goggles). (*b*) Both glasses cracked; small splinters came off both glasses. (*c*) Both glasses cracked; no splinters off either glass. (*d*) The impacted glass remained intact, but the top glass was cracked and minute splinters came off.

A further weakness was evident in the design of the test machine during this second series of tests. It was found that molten metal was being forced around the specimen so that it passed between the edge of the specimen and its retaining ring. This metal then fell back onto the top of the specimen and, in the case of some plastics specimens, was sufficient to ignite them after they had withstood the initial impact. It was decided therefore that a new type of ring should be designed to hold the specimen.

TABLE 8.—*Tests of Toughened-glass and Laminated-glass Lenses by Projectiles of Molten Cast Iron, using Maximum Spring Tension (Height of Stop-platform 24 in.).*

Head size.	Weight of Average charge (grams).	Height of specimen above stop-platform.				
		3 in.	4 in.	5 in.	6 in.	9 in.
Tests of Toughened Glass.						
Small ..	35	All specimens were completely shattered at each height by the three different charges.				
Medium	95					
Large ..	145					
Tests of Laminated Glass.						
Small ..	35	In case case the glass shattered and the lamination resin took fire.				
Medium	95					
Large ..	145					

At this stage of the work it appeared that:—(*a*) Plastics materials appeared to provide much better resistance to molten metal than either toughened-glass or laminated-glass lenses. (*b*) toughened glass appeared to be entirely unsuitable as it shattered in every test. (*c*) Laminated glass appeared to be unsuitable as it was very badly cracked by every test and splinters of glass were thrown off the surface which would be adjacent to the eye of the wearer if the specimen had been in normal use. (*d*) Plastics lens specimens did not appear to be wetted by the molten metal, and this might offer a reason for their superior behaviour. (*e*) Plastics might react differently to different metals and so tests with non-ferrous metals as the projectile were considered essential.

TABLE 9.—*Tests of Cellulose-acetate Lenses by Projectiles of Molten Cast Iron and Maximum Spring Tension (Height of Stop-platform 24 in.).*

Specimen thickness, in.	Results.
0.050	Even under maximum impact conditions, *i.e.*, the specimen positioned at 3-in., and when discharging the heaviest molten-metal charge, the acetate was not damaged. The metal marked the specimens and they were extremely pliable immediately after being struck, but there were no other reactions.
0.080	Even under maximum impact conditions, *i.e.* the specimen positioned at 3-in. and when discharging the heaviest molten-metal charge, the acetate was not damaged apart from a slight marking where it was struck by the molten metal.

Third Series

The holding ring for the specimen was modified and three ejector heads were made, arranged to contain charges of approximately 30, 95 and 145 gm. of molten iron respectively. It was then decided to carry out a series of tests using toughened-glass specimens, laminated-glass specimens and plastics specimens, each material being tested under identical conditions. Molten iron at 1,400 ± 20 deg. C. was used as the projectile throughout this series; the maximum spring tension was used; the stop platform was positioned at 24 in. above the base, and all the specimens were mounted in the new holding ring.

TABLE 10.—*Tests of Allyl-resin Lenses by Projectiles of Molten Cast Iron and Using Maximum Spring Tension (Height of Stop-platform 24 in.).*
Note.—All these specimens, which were curved in the form of a meniscus lens, were held in a ring which had been designed for flat specimens.

Specimen thickness.	Results.
3-mm.	All the specimens remained undamaged and showed no reaction even under the severest conditions of test when the heaviest molten-metal charge was projected at the shortest distance of 3 in.

Once again, the plastics materials withstood every test and, even under the maximum conditions, no single plastics lens was penetrated by the metal. The toughened-glass specimens failed every test, being completely shattered; the laminated-glass specimens also failed every time. Both glasses of each laminated lens were badly cracked each time and in some of the tests splinters were found to have left the top glass of the lens. The molten metal adhered to all the glass lenses, but did not adhere to any of the plastics at the point of impact. Some of the plastics lenses were removed from the machine with molten metal adhering at the circumference and it was thought that this might have been due to the fact that the molten metal adhered primarily, not to the specimens, but to the cold-steel holding-ring. By this time, there was sufficient confidence in the plastics specimens to operate the machine without the sheet-metal guard provided to collect the molten metal after it had penetrated the specimen. In consequence it was possible to watch the behaviour of some of the specimens under test. Fairly quick observation immediately after firing the projectile showed the molten metal falling from the face of the plastics specimen and this confirmed

TABLE 11.—*Tests of Lenses Made up from Sheet "Cobex" Material 50-mm. thick by Projectiles of Molten Cast Iron and Using Maximum Spring Tension.*
Note.—Height of stop-platform 24 in.; specimen location 3-in. above stop-platform.

Specimen thickness, in.	Average weights of projectiles (gm.).		
	35.	95 .	145.
0.006	(1) Both faces scorched; slight penetration and distortion.	(2) Metal broke through and burned top face.	(3) Complete penetration and scorching.
0.010	(16) Small globular penetration.	(17) Both surfaces scorched.	(18) Both surfaces scorched.
0.020	(31) Impacted face scorched.	(32) Impacted face scorched.	(33) Impacted face scorched.
0.030	(46) Impacted face slightly scorched at point of impact.	(47) Impacted face slightly scorched at point of impact. Whole specimen slightly distorted.	(48) Impacted face scorched; top face affected; specimen slightly distorted.
0.040	(61) Impacted face scorched at point of impact.	(62) Impacted face scorched at point of impact.	(63) Impaced face scorched overall.
0.060	(76) Impacted face scorched at point of impact.	(77) Impacted face scorched.	(78) Impacted face scorched overall.

Note.—This material appears to be susceptible to smoke, as in each test the whole of the impacted surface was rendered opaque until it was wiped clear at the end of the test.

TABLE 12.—*Tests of Specimens Cut from 50-mm. Sheet "Bexoid" Material by Projectiles of Molten Cast Iron using Maximum Spring Tension, and a Height of Stop-platform of 24 in. (Specimen Location 3 in. above Stop-platform).*

Specimen thickness, in.	Average weights of projectiles (gm.).		
	35.	95.	145.
0.005	(91) Very little effect; specimen fired where metal stuck to holding ring.	(92) Heat penetrated and affected both faces of specimen.	(93) Specimen collapsed under the blow.
0.010	(106) Slight scorching of impacted face; specimen distorted by heat.	(107) Specimen collapsed under the blow.	(108) Not tested owing to effect noted on 95-gm. charge.
0.020	(121) Slight scorching of impacted face at point of impact.	(122) Slight scorching of impacted face; specimen distorted under heat.	(123) Slight scorching of impacted face; specimen distorted.
0.030	(136) Very slight scorching of impacted face at point of impact.	(137) Very slight scorching of impacted face at point of impact.	(138) Very slight scorching of impacted face; owing to delay in removing the specimen it was destroyed by the heat.
0.040	(151) Very slight scorching of impacted face at point of impact.	(152) Very slight scorching of impacted face at point of impact.	(153) Very slight scorching of impacted face; specimen distorted.
0.060	(166) Very slight scorching of impacted face at point of impact.	(167) Very slight scorching of impacted face at point of impact.	(168) Very slight scorching of impacted face; specimen distorted.

Note.—This material did not scorch as badly as "Cobex" and was not susceptible to smoke, but was shown to be extremely weak under the impact of the molten metal blow.

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the original view that the metal did not adhere to the plastic but only to the holding ring if it touched it.

Tests with Non-ferrous Metals (Fourth Series)

It was next decided to remove the testing machine to a non-ferrous foundry, where a series of plastics and glass specimens could be tested with a range of different metals. Tables I to III give typical sets of results from these tests. Plastics specimens were tested in thicknesses varying from 0.03 to 0.06 in. 150 gm. of white-metal at a temperature of 500 ± 20 deg. C. failed to penetrate any of the plastics specimens; there was some slight adhesion of the molten metal to the surface of the plastics lens. The white-metal did not penetrate the laminated-glass lens, but a large proportion of the molten projectile adhered to the glass, which was badly cracked. Forty grammes of pure aluminium at about 750 deg. C. failed to penetrate any of the plastics specimens and the metal did not adhere to the face of the specimens. The aluminium did not penetrate the laminated glass, but it adhered to the surface and cracked the lens badly. The toughened glass was completely disintegrated by the aluminium, large globules of metal penetrating the glass and adhering to the protective canister which had been placed over it. A weight of 143 gm. of molten phosphor-bronze at about 1,150 deg. C. failed to penetrate any of the plastics specimens and the metal did not adhere to the plastic. The same weight of Admiralty gunmetal at the same temperature likewise failed to penetrate the plastics specimens, nor did it adhere to their surfaces. The gunmetal did not penetrate the laminated-glass specimen, but both surfaces were badly cracked and a large amount of the gunmetal adhered to the impact surface of the laminated glass. Some very small splinters broke away from the top surface of this laminated specimen. When projected at the toughened-glass specimen, the Admiralty gunmetal completely shattered it, the molten metal penetrating the specimen. In this test, plasticine had been mounted ½ in. above the top surface of the specimen and after the test, glass splinters were collected in this plasticine. Finally, 135 gm. of molten stainless steel (at about 1,600 deg. C.) failed to penetrate the plastics specimen though after the test, the specimens were found to be somewhat darkened and there was an overall clouding effect.

At this stage of the work, observations indicated that it was possible to shatter toughened glass without projectiles simply by means of the shock transmitted through the machine when the spring was released. This observation did not appear to be a particularly good recommendation for toughened glass, but it was decided that the machine must be modified and the holding ring in which the specimens are held has since been mounted independently of the main machine so that the vibrations from the release of the spring and the impact of the ejector head against the stop platform cannot be transmitted to the specimen. At the same time it was agreed that the velocity and the momentum available in the machine should be calibrated in order that comparisons could be made, not only between materials in use in the machine but also with other methods of testing.

TABLE 13.—*Tests on Flat "Perspex" Lenses by Projectiles of Molten Cast Iron, using Maximum Spring Tension and a Height of Stop-platform of 24 in. (Specimen Location 3-in. above Stop-platform).*

Average weight of projectiles. (gm.)	Results.
35	No effect beyond a slight scorching of the impacted face.
95	Slight scorching of the impacted face and slight distortion.
145	Slight scorching of the impacted face and slight distortion.

TABLE 14.—*Results with Heated Projectiles (1-in. dia. Steel-ball Projectile heated to 900 deg. C.), using Maximum Spring Tension and a Height of Stop-platform of 24 in.; Specimen Located 3-in. above Stop-platform.*

Specimen.	Results.
Acetate, 0.05 in. thick	Slight burn mark where struck.
Cobex, 0.06 in. thick	" " "
Bexoid, 0.06 in. thick	" " "
Allyl-resin lens.. ..	" " "
Perspex lens	" " "

Calibration of Machine

Table 4 shows the method used and the results obtained from the calibration of the machine when using solid steel ballbearings as projectiles. Table 5 indicates the calibration done on molten iron as projectile. By way of comparison, the formula $V = \sqrt{2gh}$ was applied to the British Sandard Test when the velocity at the point of impact with the lens was found to be approximately 16.4 ft. per sec. Using a ⅞-in. dia. steel ball, this would correspond to a momentum of about 738 gm. per ft. per sec. These figures are included in this report to indicate the relative severity of the present testing machine and the British Standard Test.

Fifth Series of Tests

Before commencing tests with molten metal on the modified machine, a series of tests were done on toughened-glass and laminated-glass specimens, used steel ball-bearings as projectiles. The results of these tests are given in Tables 6 and 7. It should be noted that in these tests the specimen was held rigidly in the machine, whilst in the British Standard Test some of the impact is taken by the resilience of the mounting.

A series of tests was then carried out using a variety of plastics, toughened-glass and laminated-glass specimens with molten cast iron at about 1,400 deg. C. as the projectile. In all cases the maximum spring tension was maintained and the stop platform was fixed at 24 in. above the base of the machine. The general result was that all the glass specimens were completely shattered and that all the plastics specimens which were greater than 0.010 in. thick resisted penetration by the molten metal. The results are given in detail in Tables 8 to 13. Further work still remains to be done to

arrange the various plastics materials in order of merit but the distinction between the behaviour of plastic and glass seems to be clear enough.

Hot Solid Projectiles

In order to complete the work on this machine, it was then decided to use hot solid projectiles. Solid steel ball-bearings 1 in. dia. were heated to 900 deg. C. and used as projectiles. The maximum spring tension was applied, the height of the stop platform remained at 24 in. above the base of the machine and the specimens were located at a distance of 3-in. above the stop-platform. The hot projectiles shattered the glass lenses just as readily as did the cold projectiles but the only effect that the hot projectiles had on the lenses made from plastics was to leave a slight burn mark at the point of impact; Table 14 gives the results.

Comments

The low-velocity ballistic tests conducted on the spring-loaded piston-operated machine indicated the following conclusions:—

(*a*) Toughened glass appears to be quite useless as protection against flying molten metal.

(*b*) Laminated-glass lenses are always broken by molten metal and in some cases splinters fly off from the surface of the laminated glass that would be adjacent to the wearer's eyes. It could not be said laminated glass is useless but those who have seen the experimental work would not be comfortable again when using the material.

(*c*) Plastics appear to be greatly superior in resisting penetration by molten metal, and in fact it would be generally true to say that plastics cannot be penetrated by the machine available if they exceed a thickness of 0.010 in.

(*d*) Molten metal does not appear to wet plastics surfaces but it does wet metal surfaces or glass surfaces and adheres to them. It would appear, therefore, that plastics lenses should not be mounted in metal rims because molten-metal splashes will adhere to the rim and may then set fire to the plastic.

(*e*) Plastics lenses were greatly superior to either toughened or laminated glass in withstanding the impact of either cold or hot solid projectiles.

(*To be continued*)

Polish £2,500,000 Order for Metro-Vick

Poland, it is announced, has ordered two 120,000-kw steam turbine alternators, worth £2,500,000 from the Metropolitan-Vickers Electrical Company, Limited, Manchester. They will be delivered by 1961. The order for the alternators, which are to be installed in a power station near Katowice, was placed by Elektrim (the official Polish organization dealing with the import and export of electrical equipment) with the agreement of the Board of Trade. The turbines are the largest ever ordered from the UK for use in Europe.

Mr. F. R. Mason, managing director of the Metropolitan-Vickers Export Company, Limited, said that Poland had not been one of its traditional markets and the present order had been obtained in the face of German and Swiss competition. "We hope that this is merely the first of a series of orders which will be placed with the British electrical industry," he said.

Orders for capital goods from Britain of between £30,000,000 and £50,000,000 were contemplated by Poland if it could be made possible to pay for them, Dr. A. Wolynski, Commercial Counsellor at the Polish Embassy, told a news conference last week. The conditions implied equal treatment with Western countries for Polish exports on the British market.

Asquith Machine Tool Issue

A bonus of 5 per cent., in addition to the 15 per cent. final and the 25 per cent. total, is being paid by the Asquith Machine Tool Corporation, Limited, for the year to September 30, 1957. No bonus was paid last year. Group profits were £699,569 (£666,375), and net profit after tax was £325,849 (£333,675).

It is proposed to offer 1,340,000 ordinary 5s. shares to shareholders on the basis of one-for-two, subject to market conditions and the necessary increase in authorized capital. Treasury consent has been obtained.

In the absence of unforeseen circumstances the directors estimate that the current year's profits will justify the paying of a dividend of not less than 25 per cent.

Charles Roberts' Offer for Hurst, Nelson

An offer to purchase all the £400,000 ordinary capital of Hurst, Nelson & Company, Limited, the Motherwell rolling stock, etc., manufacturers, has been made by Charles Roberts & Company, Limited, Horbury Junction, near Wakefield. The purchase would take the form of an allotment of four ordinary 5s. shares of Charles Roberts & Company for each £1 ordinary plus 5s. per share in cash. With Charles Roberts' shares worth 8s., the total value of the offer is £740,000. Acceptance is recommended by the board of Hurst, Nelson.

The offer will be conditional upon not less than 90 per cent. acceptance or such lesser percentage being not less than 70 per cent. as the directors of Charles Roberts may be willing to accept. The new Charles Roberts shares will not carry the right to dividend in respect of the financial year ending March 31, 1958.

Charles Roberts & Company has an issued capital of £1,250,000, of which £1,000,000 is in ordinary.

Carron Company's Glasgow Works to Close

Last week, the Carron Company, ironmasters, iron and non-ferrous founders, of Falkirk, announced that its works in Washington Street, Glasgow, are to close. Sheet-metal press and fabrication work undertaken there is to be transferred to the company's new factory at Falkirk and a number of the 50 to 60 workers affected are being offered employment at Falkirk.

A company executive stated that the demand for sheet-metal products was increasing and the range of steel fabrications extending. These were types of work calling for additional accommodation and more and heavier machinery, which could not be provided at the Glasgow works.

The new factory is equipped with up to a capacity of 100 tons and presses of many kinds will be produced within this range. In addition, an extensive range of mold steel plate up to 1¼-in. thickness will be fabricated.

Law Cases

Absentee halts Night-shift Production

At Tipton Magistrates' Court last month, Mr. Samuel Garner, an employee of John Bagnall & Sons, Limited, Tipton, was summoned under the Employers and Workmen's Act of 1875 for "being a workman and having entered into a contract of service with the company, he wrongfully absented himself." It was stated that Mr. Garner had caused loss of production on a night shift. For the firm, Mr. D. Royston said that as a strand roll worker, Garner had occupied a key position. It was his duty to handle hot metal and place it between the rollers. On the night of January 2, he "clocked in" but eight minutes later he left, complaining that it was apparently only his shift which was responsible for changing the rollers. The rollers, in fact, were changed impartially by each shift.

After Mr. Garner had left the factory, Mr. Royston said, the foreman and a trade union official followed him to his home to try to persuade him to return to work. He refused, however, and as a result 20 men lost wages and the firm lost production of about 20 tons of steel. Fuel, valued at about £17, had been wasted because the boilers and furnaces had been heated unnecessarily. The case had not been brought out of vindictiveness, Mr. Royston said, but it was essential that the company should not be at the mercy of irresponsible absenteeism.

Mr. Garner was ordered to pay £10 damages with £3 11s. 6d. costs to Bagnall & Sons.

Industrial Disease—No Excuse

Foundry employers had no excuse nowadays for industrial diseases being contracted by their workers, said Alderman Fred Leeson, at a West Bromwich inquest. As president of the local branch of the Amalgamated Union of Foundry Workers, Alderman Leeson, who is Mayor of West Bromwich, was commenting on the death of a moulder, Mr. Cyril Davis, at the age of 41, from pulmonary tuberculosis contributed to by silicosis. Mr. Davis had been engaged in moulding all his working life and died on January 24. The Coroner (Mr. Alan D. Clark) said he was satisfied that the silicosis was contracted by Mr. Davis at work.

Alderman Leeson said a system of side-draught extraction of dust at knocking-out stations in foundries had now been developed, and this should greatly reduce the incidence of industrial disease. It was said that the firm had carried out some improvements in the foundry and more were contemplated.

Unsubstantiated Statement—Not Evidence

Loss of an eye led to an action for £3,000 damages against William Beardmore & Company, Limited, Glasgow, brought by Mr. George Bright (28), a toolgrinder. The action, which was heard at Paisley, was dismissed by Sheriff-substitute A. K. F. Hunter, who held there was insufficient evidence to go to the jury.

After hearing some evidence the jury was asked to retire while a legal debate took place. The discussion centred on an unknown man, who was said by the plaintiff to have entered the toolgrinding shop where Mr. Bright was employed. Mr. Bright claimed that when he had switched off his lathe and was repairing the noseband of his goggles the unknown man switched it on again and began sharpening a tool. A piece of metal broke off the tool and entered Mr. Bright's left eye. For the company, it was submitted that Mr. Bright had failed to show there was any man there. In summing up, Sheriff Hunter said "The uncorroborated testimony of one witness is not evidence."

Notes from the Branches

Slough

The Slough section of the Institute of British Foundrymen had the pleasure of renewing an old friendship when Mr. A. L. Logan, of Harborough Construction Company, Limited, a founder member of the section, made a welcome return to Slough to lecture at its meeting at High Duty Alloys, Limited, on February 11.

Mr. Logan, who was introduced by the section president, Mr. A. R. Parkes, gave a very interesting and enlightening paper entitled "Feeding Aids to Castings." He commenced by giving two main reasons for studying the principles of the running and feeding of castings, tabulating these as follow:—(1) To obtain maximum soundness; (2) to obtain maximum yield and economy; the first point, he said, is essential and the second very desirable. He continued by describing three general methods of running castings, *i.e.* top pouring, gating at the joint, and bottom pouring, explaining that each method had its own merits, and that each casting should be considered for its individual requirements before deciding which casting method to use. He went on to give a description of the theoretical and practical requirements for the adequate feeding of castings, and gave details of special forms of feeders. A point which he stressed was the importance of maintaining the feed metal in a liquid state until the casting had solidified; to achieve this Mr. Logan recommended the use of foamed-plaster contained feeders, and exothermic compounds. Throughout his paper he illustrated his points with a number of excellent lantern slides.

In the ensuing discussion Mr. Logan very ably replied to the many and varied questions which members put to him, and the meeting closed with a vote of thanks, proposed by Mr. J. Wood and seconded by Mr. P. Hoesli.

Northampton Section

A meeting of the Northampton section was held at the Hind Hotel, Wellingborough, on January 16, when Mr. J. Henderson presented a paper entitled "The Hot-blast Cupola as an Economic Unit for Producing Castings to BSS 1452 Grade 12." Mr. Henderson spoke from experience gained from intimate contact with a foundry where a hot-blast cupola had been installed. He reported that many advantages had been gained from its use, including close metallurgical control when an all-scrap charge was used; the achievement of a very high temperature (1,600 deg. C.); a reduction in foundry scrap and the degree of economy which was possible.

He illustrated the layout of the plant, pointing out special features; he also showed various temperature-control records and daily melt-control sheets. It was stressed that with hot-blast water-cooled cupolas, efficient tuyeres were essential otherwise cold iron was likely to result after shut-downs. Dealing with mechanical aspects, Mr. Henderson said that once the plant had settled down to routine operation, maintenance had occupied only a few man/hours per week, and that duplicate equipment which had been installed for use in the event of a breakdown had not been used.

Mr. L. W. Bolton proposed the vote of thanks, and in his reply Mr. Henderson said that the reason why the paper had been written was because it was felt that whilst there was much published on the theoretical aspect of hot-blast cupolas, very little practical information on actual operating detail had been disseminated.

"Proof of the Pudding" . . . *Plant Manufacturers use Prototypes in their Own Foundry*

Continuing the series of inspections of the works of manufacturers of foundry equipment, the JOURNAL *representative recently visited the foundry and engineering works of George Tweedy & Company, Limited, at Chipping, in Lancashire. Here, the "Vortec" range of plant is produced for British Foundry Units, Limited, of Chesterfield, who act as sole distributors of this line.*

The old-world village of Chipping is delightfully set in the famous Trough of Bowland country and the foundry and a chair-making concern provide its sole industry, although the majority of employees (some 230) travel by bus from Preston and Longridge, a journey of up to 28 miles daily. Before taking up the production of foundry plant and equipment shortly after the war, one section of Tweedy's business catered for the food-processing industry, standard lines including potato-peeling machines, chip-cutting and slicing machines, and machines for processing raw vegetables. Another section, and the oldest, is the supply of ships' fittings, first produced by this firm in 1865. Fittings for the Shamrock racing yachts were produced here and latterly fittings of a similar nature for the Mayflower (the firm having received a letter complimenting them on the traditional quality of these items. Yet another section is devoted to the manufacture of machinery, of which the firm holds the Patent, for the reducing of biscuits to be reconstituted, now in use in almost every country where imports of this nature are allowed. The latest product for dealing with food is an egg-breaking and emulsifying machine, capable of dealing with 100 eggs per minute (the writer was told that paradoxically the biggest customers for these are the egg-packing stations!).

Foundry

The premises comprise a small iron foundry where melting is practised twice weekly and there are also facilities for non-ferrous melting. The shop (Fig. 1) is well laid out and there are a number of mechanical aids. The principal, Mr. E. Brooks, is of an inventive turn of mind and a draughtsman of no mean capabilities, thus the foundry has become a design centre and proving ground for the foundry equipment produced by the firm. It follows that only items of plant proved in service in the foundry over quite a long period are developed for sale throughout the industry. A view of melting and pouring at the Chipping foundry is shown in Fig. 1.

Readers of the JOURNAL will be familiar with the range of core and moulding sand-mixing equipment produced by this firm, and available in sizes taking from 56 to 400-lb. charges. What is not so generally known is that the same machines can be applied (with special interior fittings) for reclaiming used cores and used CO_2-practice sand. This procedure, as well as operation of the firm's other foundry machinery, was witnessed by the writer and appeared to be quite effective.

An interesting item of Tweedy's foundry practice is the production of lining plates for the firm's rumbling barrels and similar machines which incorporate cast-in granular silicon-carbide. The result is a wickedly-abrasive surface of good lasting characteristics which serves for a multitude of applications involving surface-removal from the items treated (as, for instance, the firm's potato-peeling machine). The firm has used a rumbler barrel for six years in its own foundry and this is built up of eight of these abrasive plates. It is claimed that the silicon-carbide coating speeds sand removal from the castings treated and although the silicon carbide does

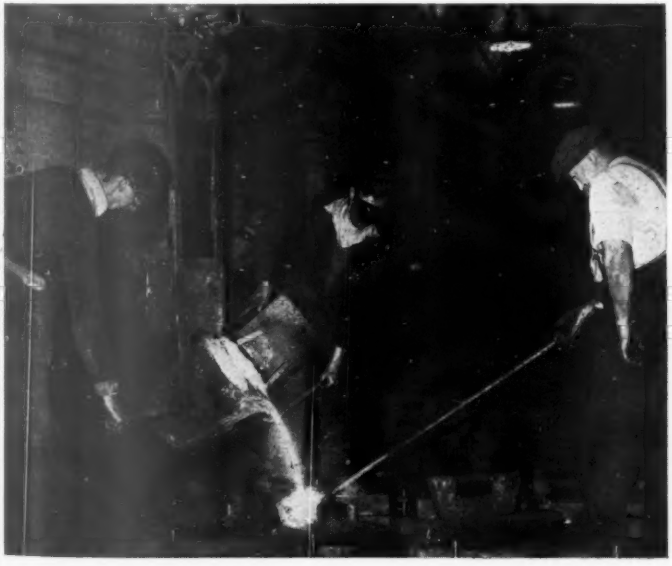

FIG. 1.—*Melting and pouring is a bi-weekly event at the Chipping foundry and the floor-bank system of mould storage is practised. Note the double-yoke type of ladle suspension and the baffle-plates arranged to protect the ladlemen.*

" Proof of the Pudding "

wear down after a time, the tumbling action even after a long period is said to be superior to rumblers with smooth interiors. Another machine for foundry use which incorporates these plates is a rotary-drum type of core breaker. This design is similar to the rumbling barrel, but one of the abrasive sections is replaced by a window covered with fine wire mesh which permits the escape of fine sand abraded from the lumps of used cores with which the barrel is loaded. The output from this prototype machine is given as five cwt. per hour of dry sand suitable for re-incorporation up to quite a high percentage in normal core-sand mixes.

Other Sand

In the firm's sand-preparation plant, the usual type of static sand-drier comprising a tapering wedge-shaped hopper with a horizontal firebox inside has been modified by the introduction of built-in heat-circulating tubes connecting the firebox with the chimney. The result is a much-extended drying surface and it is claimed the production reaches approximately two tons of dried sand for every cwt. of coke consumed, the daily throughput being 2 to 2½ tons. A simple, but efficient, shaking device is incorporated which, operated intermittently, serves to prevent the sand from sticking. Although this machine is of welded steel-plate construction, the firebars and some other details are, of course, cast in the Chipping foundry.

Machine and Finishing Shops

A number of items, including castings, from the firm's production were at one time galvanized on the premises but the fumes proved so damaging to the structure of the building that this work is now sent out and more space has been released for extension of the firm's machine and assembly shops. The principal machine tools now include capstan and turret lathes, horizontal and vertical boring machines and both small and large centre-lathes (to swing up to 36-in. dia.). Machine assembly is carried out on a batch-production basis and in this shop it was noted that " number 500 " of the firm's sand mixers was just being put together.

Value of a Proving Ground

From this series of visits undertaken by JOURNAL staff to the works of plant manufacturers, it is becoming increasingly clear that the practice of " proving the pudding " is more widely practised in the foundry-equipment industry of this country than in any other. Thus it is that nearly all manufacturers of foundry plant have their own foundry or a controlling interest in one where new items of equipment can be thoroughly " put through their paces " on a production basis before being placed on the market. If necessary, modifications can be made in the light of experience so gained, before any customer receives the plant. This system, which is obviously followed at George Tweedy's, is a good augury for successful trading, particularly in the export market. The writer, from personal experience knows how galling it is for the men on the spot when an overseas foundry receives a piece of equipment which after a few days' or weeks' operation reveals—by constant breakdowns—that it has not been designed sufficiently robustly to stand up under foundry conditions.

In conclusion, the writer thanks the directors of both the Chesterfield concern and George Tweedy's for permission to visit these shops and inspect the manufacturing facilities which are to such a large extent at the disposal of the foundry industry.

Steam and the Ironfounder

Up to the time of James Watt, steam engines had been of the " atmospheric " type in which the steam was only used to provide one impulse in the cylinder and then, on condensation by a jet of water, or other means, to leave a vacuum within the cylinder. Atmospheric pressure acting on the other side of the piston produced that return stroke in engines with which the name of Thomas Newcomen is usually associated.

Watt, when he was repairing a model of Newcomen's engine for Glasgow University in 1763, observed the great loss of energy (or heat) due to the condensation of the steam when the vacuum was made inside the cylinder and he conceived the idea of condensing this steam outside the cylinder. Thus was born the condenser and this made the way for two-stroke steam engines and in turn, to the high-pressure machines which were developed later by Richard Trevithick.

In about 1770 Watt began on his first real engine—with an 18-in. cylinder—but since he was using low steam-pressure to move the piston both ways, he found that the cylinder as cast by the moulder might be circular in its horizontal sections but was seldom parallel or straight so far as its longitudinal sides were concerned. In the older engines this had not mattered so much since a layer of condensed water on the top of the piston head (the engine being vertical) had proved a fairly efficient seal. Now, with steam pressure acting on both sides (and this steam condensed outside the cylinder), greater precision in manufacture and better packing of the piston became essential.

This accuracy in cylinder manufacture was provided by a new method introduced by John Wilkinson and with the assistance in factory facilities. Capital and business acumen being provided from 1774 onwards by Matthew Boulton at his Soho works near Birmingham, Watt was able to concentrate on construction and improvement. Watt and Boulton engines then found their way to mines in Cornwall and elsewhere for pumping and for supplying blast in furnaces. The makers as a rule hired out their engines on licence, the cost of hire being set at one third the value of the coal saved by using them, compared with that used by an earlier atmospheric engine doing the same work and using fuel of equal quality.

The saving was calculated by a counter, attached to the engine, which was struck at every ascent of the working beam. Two keys for separate locks for this counter apparatus, were kept, one by the patentees (Watt and Boulton) and the other by the licencees using the engine. A traveller on behalf of the patentees called at the mine or forge periodically to examine the counter in the presence of the user and to calculate from the number of strokes the amount of coal saved.

IBF Section Dinners

Stoke-on-Trent's First Function

The first dinner/dance of the Stoke-on-Trent section of the Lancashire branch of the Institute of British Foundrymen which took place at the Grand Hotel, Hanley, on Friday, February 21, proved to be one of the most successful functions ever held in the Potteries and will be remembered as an historic occasion by the local foundrymen. With such a fortunate precedent the function will probably now take its place as an annual event.

About 150 guests attended and seated at the president's table were the Mayor and Mayoress of Newcastle-under-Lyme, Alderman W. E. Welsby, J.P., and Mrs. Welsby, and the national president of the Institute, Mr. J. Blakiston, Mr. G. Lambert, general secretary, Mr. E. H. Beech, president, Lancashire branch, Mr. F. Nield, hon. secretary, Lancashire branch, Mr. J. Darby, A.M.I.E.E., president, Stoke-on-Trent Engineering Society, and the section hon. secretary, Mr. J. Bailey, most of whom were accompanied by their ladies.

Mr. H. Charsley acted as toastmaster and dance M.C. The main toast of the evening "The Institute of British Foundrymen and Stoke-on-Trent Section" was proposed by Alderman Welsby, J.P., who, during the course of an exceptionally witty speech, paid tribute to the work of the Institute and appealed to the apprentices and younger men of the industry to take advantage of the technical facilities made available by the lectures. The national president made a suitable response and suggested the target of the section should be the attainment of branch status. The section president, Mr. R. Lewis, proposed "Our Guests and the Ladies," and in doing so thanked those especially who had made lengthy journeys in support of the occasion, and paid tribute to the work of the section hon. secretary.

Mr. E. H. Beech, in reply, complimented the section on its achievements during the past two years, and expressed his pleasure at seeing such a pleasant gathering. The Lord Mayor of Stoke-on-Trent, Rev. A. Perry, paid a visit later in the evening having had a previous engagement, and wished the section all success in its future efforts.

Beds & Herts

The national president of the Institute of British Foundrymen, Mr. J. Blakiston—the first holding that office ever to attend the function—was agreeably surprised to find an attendance of over 90 members and guests at the annual dinner of the Beds & Herts section of the London branch. The gathering was held in the Wilbury Hotel, Letchworth, on February 28 and was organized by the local secretary, Mr. W. Twaddle, with Mr. L. A. S. Harbourne, M.C., as toast-master. With Mr. G. A. Smith, the section president, at the high table were Mr. F. C. Baker (vice-president); Mr. E. Daybell; Mr. A. F. Hammond; Mr. W. T. Hobkirk; Mr. A. Talbot and Mr. A. R. Parkes (branch president and secretary, respectively); Mr. F. Rowe, B.SC.; Mr. A. S. Beech Mr. W. A. Ritter and Mr. H. W. Keeble.

Mr. Smith after proposing the "Loyal Toast," made a few introductory remarks during which he mentioned the indebtedness of the section to the firms who had provided accommodation and other assistance for lectures, also to the lecturers themselves who had come along, sometimes at great inconvenience, to present their papers. Mr. Hammond who proposed the toast to the visitors complained that Mr. Smith had "stolen his thunder," but nevertheless he found plenty of prominent people to mention amongst the guests. In responding Mr. Rowe congratulated the section on its status and commented on is rapid progress. "The Beds and Herts Section" was proposed by Mr. Blakiston, and in replying Mr. Keeble said the dinner was the first such function actually to be held in Letchworth, and he was pleased to report that the section now had 140 members of whom 40 to 60 attended each meeting. The final speaker was Mr. Talbot who said how important it was for young sections, like the Beds & Herts, particularly to foster young people in industry. Later in the evening, entertainment was provided by singers, Joan Sherington and Tom Patterson, comedian Trevor Little, and Frank Goldup, pianist and accordionist.

METALASTIK, LIMITED—Mr. G. F. Laurence, personal assistant to Mr. M. Goldsmith, chairman and managing director, has been appointed to the board.

The photograph shows members and guests at the dinner/dance of the Stoke-on-Trent section of the Lancashire branch of the Institute of British Foundrymen.

Seated (left to right): The Mayoress of Newcastle-under-Lyme, Mrs. W. E. Welsby; the Mayor of Newcastle-under-Lyme, Ald. W. E. Welsby, J.P.; Mr. R. Lewis, section president; Mrs. J. Blakiston; Mrs. E. H. Beech; Mr. J. Blakiston, national president; Mr. E. H. Beech, president, Lancashire branch; and Mrs. Lewis.

Back row: Mr. J. Bailey, section hon. secretary; Mr. F. Nield, hon. secretary, Lancashire branch; Mrs. F. Nield; Mr G. Lambert, general secretary, and Mrs. Lambert.

British Blast Furnaces in the December Quarter, 1957

(These tables are published through the courtesy of the British Iron and Steel Federation.)

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the fourth quarter, 1957.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Clay Cross Co. (Iron & Foundries)	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	—	3	—	3	3	4
Kettering Iron & Coal	—	—	1	—	1	1	2
New Cransley Iron & Steel	—	—	—	—	—	0.3	2
Renishaw Iron	—	—	2	—	2	2	2
Sheepbridge	—	1	—	—	1	1	2
Stanton Ironworks: Stanton-by-Dale	—	1	3	—	4	4	5
Staveley Iron & Chemical	—	—	4	—	4	4	4
Stewarts and Lloyds: Corby	—	4	—	—	4	4	4
Wellingboro' Iron	—	1	—	—	1	1.3	3
TOTAL	—	7	15	—	22	22.6	31

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel Works	—	1	—	—	1	1	1
Darwen & Mostyn Iron	—	—	—	1	1	1	2
Lancashire Steel Corporation	—	2	—	1	3	2.6	3
Summers, John	—	2	—	—	2	2	2
TOTAL	—	5	—	2	7	6.6	8

North-West Coast.

Barrows Ironworks	2	—	—	—	2	2 9	4
Charcoal Iron	—	—	1	—	1	0.9	1
Millom & Askam Hematite Iron	2	—	—	—	2	2	2
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	6	—	1	1	8	8.8	10

Lincolnshire.

Appleby-Frodingham Steel	—	4	—	—	4	4	4
Lysaght's Scunthorpe Works	—	3	—	—	3	3	4
Thomas, R., & Baldwins: Redbourn	—	3	—	—	3	3	3
TOTAL	—	10	—	—	10	10	11

North-East Coast.

Consett Iron	—	3	—	—	3	2.5	3
Dorman Long (Steel): Acklam	—	2	—	—	2	2	4
Redcar	—	2	—	—	2	2	2
Bessemer	—	1	—	1	2	2	3
Clay Lane	—	2	—	—	2	2	2
Gjers, Mills	2	—	—	—	2	2	5
Normanby Iron Works	2	—	—	—	2	2	3
Skinningrove Iron	—	2	—	—	2	2	3
South Durham Steel & Iron: West Hartlepool	—	2	—	—	2	2	2
Cargo Fleet	—	—	—	—	2	2	3
TOTAL	4	16	—	1	21	20 5	30

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	1	—	3	3	4
Carron	—	—	1	—	1	1	4
Colvilles: Clyde Works	—	2	—	—	2	2.9	3
Ravenscraig	—	1	—	—	1	1	1
Dixon's Ironworks	—	2	—	—	2	2	6
TOTAL	1	6	2	—	9	9.9	18

South Wales and Monmouthshire.

Briton Ferry Works	1	—	—	—	1	1	1
Guest Keen Iron & Steel: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	3	—	—	3	3	3
Steel Company of Wales: Margam	—	4	—	—	4	4	4
TOTAL	2	9	—	—	11	11	12

Planning for Redundancy

One of the principal lessons to be drawn from the Minister of Labour's report on the unemployment situation in the House of Commons last week, appeared to be on the basis of "a stitch in time." Industries and managements, particularly where demand could vary a great deal, should think out in advance what they would do if redundancy came to their firms, said Mr. Iain Macleod, the Minister. He went on to give examples where his department had been able to help because long notice of probable changes had been given and there had been most careful planning. In such matters, he said, there should be just as careful planning as in problems affecting raw materials and technical processes.

The Minister did not burk the details of the present employment situation. At the end of December the employment figure was higher than in any previous December, and although the January unemployment rate of 1.8 per cent. was higher than in some recent years, it was only one tenth of 1 per cent. higher than the average for the past 10 years. Approximate figures for February showed that unemployment had risen by 28,000 to a rate of 1.9 per cent. —a smaller increase than the "leap" in January, but, he frankly admitted, it appeared to be a real and not a seasonal increase. In the areas which caused most concern the increases were:—2,000 in Wales (3.8 per cent.) and 6,000 in Scotland (3.6 per cent.).

Iron Ore from Brazil

Another considerable source of high-grade iron ore may materialize as a result of a US surveying and prospecting unit's visit to Brazil. The trip is the outcome of the acquisition of the controlling interest by the M. A. Hanna Company of Cleveland, Ohio, through its subsidiary, Hanna Coal & Ore Corporation, together with Leo Model, New York, in the 125-year-old British company, St. John d'el Rey Mining Company, Limited, which, for many years, has operated the largest gold mine in Brazil.

The British company has what is believed to be the largest single holding of high-grade iron-ore reserves in Brazil, its properties comprising a tract of over 100 square miles. The Brazilian deposits have long been thought to be the largest high-grade iron-ore reserves in the world. They are estimated at hundreds of millions of tons of 60 to 70 per cent. ore compared with the 50 per cent. ore being shipped from the Mesabi Range in Minnesota.

The expedition will investigate the gold properties of the territory, explore fully the iron-ore reserves, and study the problems of transportation and shipment. If suitable local arrangements can be made and economic conditions warrant, it is believed that the properties could be brought into commercial production within three years and the ore marketed competitively in the US, Britain, and western Europe.

The project is comparable to the recent Labrador iron-ore development conducted by the Hanna Company together with Canadian mining and American steel interests. This required nearly 10 years of preparation and the expenditure of nearly $300,000,000 to create mines, railroads, town sites, and port facilities. Last year about 12,500,000 tons of iron ore were shipped from Labrador and with the production from the Minnesota, Michigan, and Missouri mines, brought the company's total shipments in 1957 to 26,000,000 tons, making it by far the largest independent shipper of iron ore in the world.

SHEFFIELD EMPLOYMENT EXCHANGE placed more people in jobs during January than in any single month of the past year. The unemployment percentage rate, under 0.7, is still less than half the average for the country.

British Blast Furnaces in the December Quarter, 1957—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the fourth quarter, 1957.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall Iron & Steel	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	—	—	—	—	2
Shelton Iron & Steel	—	2	—	—	2	2.2	3
Stewarts and Lloyds: Bilston	—	2	—	—	2	2	3
TOTAL	—	4	2	—	6	6.2	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	1.9	2
GRAND TOTAL	13	59	20	4	96	97.5	134

Weekly Average Number of Furnaces in Blast during the December Quarter, 1957, and the Previous Four Quarters

District.	1956.	1957.			
	Dec.	March.	June.	Sept.	Dec.
Derby, Leics., Notts., Northants and Essex	27	26.1	25.3	24.5	22.6
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	7	6.8	6.6	6	6.6
Lincolnshire	9.1	10	9.7	9.7	10
North-East Coast	19.8	19.5	21.1	20	20.5
Scotland	9	8.5	9	9.7	9.9
Staffs., Shrops., Worcs., and Warwicks.	6.6	7	7	7	6.2
South Wales and Monmouth	10.3	9.9	11	11	11
Sheffield	2	2	1.1	1	1.9
North-West Coast	8.2	8.6	8.4	8.8	8.8
TOTAL	99	98.4	99.2	97.7	97.5

The following companies have furnaces in course of construction or rebuilding:—Lancashire Steel Corporation Millom & Askam Hematite Iron; South Durham Steel & Iron (West Hartlepool); Steel Company of Wales.

Production of Iron Castings in Italy

Italian production of iron castings has been growing continuously for many years. From 400,000 *tonnes* recorded in 1938, it went up to 497,000 in 1952, 530,000 in 1953, 600,000 in 1954, 610,000 in 1955, 670,000 in 1956, and 700,000 in 1957. Although this last figure represents only about 80 per cent. of the capacity of the plants existing in Italy, there are signs that the upward trend in the output is beginning to slow down.

There are several reasons for this. Approximately 200,000 *tonnes* of foundry iron are produced in Italy and the rest has to be imported from Norway, Russia, and Australia. Five per cent. duty is charged on these imports and this increases the costs of Italian producers. About 350,000 *tonnes* of scrap metal and 200,000 to 220,000 *tonnes* of coke have to be imported every year and this constitutes another drawback.

As to the equipment and methods, Italian foundries are quite up to date, but of course modernization has made less progress at smaller foundries which cannot do much in the way of research. It is hoped, however, that the "Scientific Foundry Institute" proposed by Ing. Pensotti, president of *Assofond*, will soon become a reality and benefit the whole industry by placing the latest results of research at its disposal.

BRITISH CHROME & CHEMICALS, LIMITED—Mr. W. H. Coates has been appointed to the board.

Company News

JOHN BOLDING & SONS, LIMITED, brassfounders and engineers, of London, W.1—The company is seeking CIC consent to make a one-for-one capitalization issue.

WILLIAM DENNY & BROS., LIMITED, shipbuilders and engineers, of Dumbarton—Sixty-four per cent. of the rights offer of 125,000 ordinary shares, to existing ordinary shares at 32s. 6d. each, was taken up by shareholders. The balance will be taken up by the underwriters.

HENRY BALFOUR & COMPANY, LIMITED, gas and chemical engineers, of Leven (Fife)—The final dividend is 10 per cent., making 16½ per cent. Last year an 8½ per cent. final made 15 per cent. Group profit for the year to October 31 is £102,989 (£89,480), and net profit after taxation of £55,250 (£42,600) is £47,739 (£46,880).

BRUCE PEEBLES & COMPANY, LIMITED, manufacturing electrical engineers, etc., of Edinburgh—The company is repeating the 25 per cent. ordinary dividend for 1957, but on this occasion there is a bonus of 5 per cent. (nil). A 2½ per cent. participating dividend on the 7½ per cent. preference again makes the 10 per cent. maximum for the year. Profits, after tax, but before £62,000 (£39,600) depreciation, total £267,168 (£185,558).

BRITISH OXYGEN COMPANY, LIMITED—Increase in home and overseas sales helped to counteract the continued heavy increase in operating expenses. After substantially heavier depreciation and tax charges, the profit balance is £2,748,986 (£2,498,853) and the profit attributable to the company, £2,440,245 (£2,260,906). Group profits increased by £1,370,000 to £9,181,548, and the ordinary dividend is held at 10 per cent. with an unchanged 6 per cent. final.

MIDLAND ELECTRIC MANUFACTURING COMPANY, LIMITED—In addition to maintaining the ordinary dividend at 12½ per cent. the company is paying a jubilee bonus of 2½ per cent. Group trading profit for 1957 is £504,817 (against £474,656 including subsidiaries for 15 months). With investment interest, etc., of £12,902 (£19,459), the total is £517,719, compared with £494,115. After taxation of £275,876, compared with £245,150, the net profit is £241,843, against £248,965.

MONSANTO CHEMICALS, LIMITED—The chairman, Sir Miles Thomas, states that the demand for established products is well maintained and new products introduced during the year are meeting with an encouraging response. Consolidated trading profits rose to £3,093,669 (£2,596,773) and the net profit, after tax, is £1,078,557 (£919,315). Net sales of the parent company increased by 11¼ per cent. to a new record of £15,683,272, with 41 per cent. of the total business effected overseas at a value of £6,416,204 (£5,821,357). A second interim of 8½ per cent., making 13½ per cent. total on the ordinary capital doubled to £5,400,000 by a one-for-two rights issue and a one-for-three scrip issue, is announced.

BRITISH RAILWAYS ANNOUNCE that, beginning this month, their "Green Arrow" registered transit arrangement, under which consignments are specially watched and notified at various control points throughout the journey, will be extended to all classes of freight traffic conveyed in full wagon-loads. This service, for which a registration fee of 2s. 6d. per consignment is payable, was formerly available only for full wagon-loads for shipment, and for all perishable, livestock and household-removal traffic.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

787,005. Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, 14, Ohio, USA.

A foundry moulding process utilizing both core-blowing and squeezing operations. It is one of the objectives of the invention that the method will not require the provision of special flasks. A pre-formed sand mould is blown about a pattern within a box. The pre-formed mould and pattern are withdrawn as a unit from the box. A flask is then placed about this pre-formed mould which is squeezed with the flask to ram the sand uniformly. The pattern is then drawn through the finished mould.

787,040. Chicago Railway Equipment, Company, 1928 West 46th Street, Chicago, Illinois, USA.

Pistons for internal-combustion engines, especially diesel engines, which are made from aluminium in the major parts, and from grey cast iron in the parts subject to unusually heavy service conditions.

787,437. Gutenhoffnungshutte Sterkrade, AG., Lipperfeld, 1, Oberhausen, Rheinland, Germany.

A device for feeding a melt with an addition which tends to vaporize when contacting the melt. In particular, this patent refers to the addition of magnesium into an iron melt.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BORDER, March 14—Construction of 350 lin. yd. 12-in. dia. outfall sewer in cast iron, with the construction of a new disposal works to deal with a d.w.f. of 157,500 gallons per day. Documents from Council's Engineer, Council Offices, 7, Victoria Place, Carlisle. Deposit, two guineas.

PEWSEY, March 28—Construction of approx. 19,000 lin. yd. of spun-iron water mains. Documents from F. H. M. Sargent, Clerk of the Council, Council Offices, Pewsey, Wilts, on payment of deposit of £5 5s.

POOLE, April 10—Construction of a sewerage system at Hamworthy, Poole, Dorset, consisting of the following:—About 2,300 lin. yd. of s.g.w. concrete and cast-iron gravity sewers from 6-in. to 21-in. dia., including manholes, house connections and sundry works; about 4,700 lin. yd. of 14-in. and 15-in. dia. cast-iron pumping mains, with the alternative use of concrete pressure pipe, and two sewage pumping stations. Documents may be obtained, on payment of a deposit of ten guineas, from the Consulting Engineers, J. D. and D. M. Watson, 18, Queen Anne's Gate, Westminster, S.W.1.

ROCHESTER, March 20—Providing and laying of approximately 100 yd. of cast-iron and stoneware surface water sewer, together with various piling, manhole, gully and outfall works in Canal Road, Strood. The drawings and general conditions of contract may be inspected at the City Surveyor's Department, 66, Maidstone Road, Rochester, during normal working hours. The form and conditions of tender, additional conditions of contract, specification and bill of quantities may be obtained at the above address on payment of a deposit of £2 2s.

WITHNELL, LANCS, March 8—Supply of the following during the year ending March, 1959, for the Urban District Council:—Cast-iron street gullies and manhole covers. Documents from the Surveyor, Council Offices, Brinscall, enclosing stamped addressed envelope.

STIRLING, March 21—Supply of the following during the year from May 16, 1958, for County Council:—Cast-iron frames and gratings. Documents from the County Clerk, County Offices, Viewforth, Stirling.

BURMA, March 13—Cast-iron soil junctions and bends, galvanized iron pipes, elbows, and reducing elbows, tees and sockets. (ESB/5610/58.)

INDIA, March 31—Complete machinery and equipment to establish a cotton-spinning mill at Kalyani. (ESB/5279/58.)

Iron Castings in 1957

Total Output

The United Kingdom output of iron castings in 1957 was 3,715,000 tons, compared with 3,899,000 tons in 1956. The production of iron castings in the fourth quarter of 1957 at 962,000 tons was 1 per cent lower than in the fourth quarter of 1956 but 14 per cent. higher than in the third quarter of 1957. Production in the fourth quarter is normally higher than in the third quarter because the holiday months fall in the third quarter.

Apart from the automobile industry, 1957 has been a disappointing year for many of the ironfounders' best customers and a difficult one for the industry itself. The industrial recession which developed late in 1956 continued in many cases throughout 1957, and this has been reflected in the overall demand for iron castings.

Main Sections

Table 1 shows the output of iron castings in the fourth quarter, and in the year 1957, for each of the six main sections of the ironfoundry industry compared with the corresponding periods in 1956:—

TABLE 1.—*Output of Iron Castings for the Fourth Quarter of* 1956 *and* 1957.

Section (Grey and malleable iron castings).	Tons.				1957 percentage change on corresponding periods in 1956.	
	1956.		1957.			
	Oct. to Dec.	Jan. to Dec.	Oct. to Dec.	Jan. to Dec.	Oct. to Dec.	Jan. to Dec.
Automobile (including tractors)	106.7	463.0	145.1	516.2	+36.0	+11.5
Engineering* ..	361.3	1,448.3	338.6	1,324.2	− 6.3	− 8.6
Building and domestic ..	149.5	560.5	146.1	563.7	− 2.3	+ 0.6
Pressure pipes† and fittings ..	157.3	684.3	133.6	531.9	−15.1	−22.3
Ingot moulds‡ ..	111.1	429.7	109.9	434.3	− 1.1	+ 1.1
Railway equipment ..	87.6	313.4	88.7	344.8	+ 1.3	+10.0
Total ..	973.5	3,899.2	962.0	3,715.1	− 1.2	− 4.7

* Including machine tool, textile machinery, electrical, shipbuilding, etc.

† Mainly gas and water.

‡ Mainly for the steel industry.

The recovery which has taken place in the automobile industry is reflected in the near-record castings output figures, achieved for this section in the fourth quarter of 1957. Production of castings for the engineering industry was lower in 1957 compared with 1956 and also for the fourth quarter of 1957, compared with the fourth quarter of 1956. Production for the building and domestic section was well maintained in the year, but a small reduction below the fourth quarter of 1956 level, is apparent in the fourth quarter of 1957 and this is also true in the case of ingot moulds where the easing in the demand for steel had its effect at the end of the year. The output of pressure pipes and fittings was markedly reduced over the year and this may partly be attributed to reduced spending by local authorities on projects involving the use of pipes—sewage, water mains, etc. In the case of cast-iron railway equipment, the buoyant output which has been a feature of the year continued in the fourth quarter.

Raw Materials

The ironfounding industry's consumption of its principal raw materials is shown in Table 2:—

TABLE 2.—*Pig-iron and Scrap Consumption by Foundries.*

—	Tons.				1957 percentage change on corresponding periods in 1956.	
	1956.		1957.			
	Oct. to Dec.	Jan. to Dec.	Oct. to Dec.	Jan. to Dec.	Oct. to Dec.	Jan. to Dec.
Pig-iron (including refined iron)	583.8	2,393.2	553.1	2,159.0	− 5.3	− 9.8
Scrap (about half is foundry circulating scrap) ..	790.8	3,100.3	826.1	3,121.3	+ 4.5	+ 0.7

Labour

The number employed in the ironfounding industry at December 28, 1957, was 137,300—a slight reduction in the labour force from the end September figure of 137,900 and a 2 per cent. reduction on the end 1956 figure of 140,300.

Daily Mail "Ideal Home" Exhibition

It is several years since the writer visited Olympia during the run of the Daily Mail "Ideal Home" exhibition and he was agreeably surprised to find that the organizers had eliminated one great drawback to be associated with such shows, that is, fatigue. The cure has been effected by the extensive use of springy carpets. The view from the gallery at the Addison Road end presents an extraordinary piece of showmanship, for it depicts a French—architecturally excellent—township traversed by a tree-lined boulevard and the promenaders along this are the only human beings to be seen. A curiously peaceful vista has thus been obtained. The artistic exhibits loaned from the great houses of the country, and the French national stand are of truly high order. The exhibition in general makes a great appeal to womenfolk, but those interested in the products of the foundry will find much to interest them in the enormous range of oil, gas and electric cookers, and space-heating stoves and refrigerators. A visit to the exhibition, if the time be chosen so as to avoid crowds, is a refreshing experience.

Course for Schoolboys

A four-day course for schoolboys, to commence on April 8, has been arranged by the Motherwell Bridge & Engineering Company, Limited. It is reported that a most encouraging response has been received to the company's offer to show schoolboys the working of a modern engineering organization, and, in fact, over 200 applications have been received. Of these, only 20 can attend the course, and in the difficult task of selection the firm has been assisted by the staff of the Youth Employment Service.

Two Tips

CO_2 Practice. The use of porous patterns is suggested as a means to harden moulds where it is most needed. *Hydrogen in Steel.* The purging of metal with plastics is suggested, as this treatment is said to reduce the hydrogen content by 50 per cent., when present to the order of 0.00008 per cent. The plastic suggested is C_2 F_4 or Telfon. Both these tips are culled from *Modern Castings.*

Book Review

Gray Iron Castings Handbook. Edited by Charles F. Walton and published by the Gray Iron Founders Society, Inc., Cleveland, Ohio. Obtainable by non-members of the Society from the Penton Publishing Company, Limited, 2, Caxton Street, London, S.W.1; price about £4.

Ten years hard work by a number of eminent foundry technologists have gone into the production of this very complete compendium of data relative to grey, spheroidal-graphite, white and high-alloy irons. Malleable cast iron is not included, as in America the manufacturers of this product are separately organized.

The first chapter is devoted to the history of the ironfoundry industry, and intelligent compression has, in a most interesting manner, brought out many of the salient features and outstanding productions over the ages. A wide selection of castings, some quite novel in application, has been used to illustrate chapter II, which is devoted to "advantages" possessed by grey iron. Moreover, the campaign for greater use of castings is carried into the "enemy camp" and Table I shows how it is very much cheaper to use grey-iron castings rather than "weldments." Then again, Table II shows the hours/machine-time saved when using grey-iron crankshafts as against those of forged steel. Thus, having been shown the field for grey iron, in chapter III the user is given reliable data as to how to design so as to enable the founder to produce castings satisfactorily, and attention is drawn to the fact that he has—at a price of course—eight different processes to choose from. The reviewer was particularly impressed with seven paragraphs giving advice as to the preliminary design sequence. They are: (1) From the layout and overall specifications, establish the service conditions for the casting; (2) determine the static and dynamic forces and other critical requirements; (3) lay out the structural skeleton to determine the best arrangement for function, consider the effects of points (1) and (2); (4) make a tentative selection of the type of iron to be used; (5) check the stress and deflection, if these be critical, and evaluate the tentative selection; (6) consider the general appearance from the point of utility and sales appeal or consult with an industrial designer on these points, and (7) talk to the foundryman to determine casting quality, cost and delivery before locking in the design. The reviewer believes that after a thorough study of this chapter a foundryman can talk to designers on equal terms, which is an important factor in sales. In the list of references quoted in the book, no mention is made of the availability of the Council of Ironfoundry Association's translation into English of the French publication "Practical Guide to the Design of Grey-iron Castings."

More aids to the selling of castings are disclosed in chapter 4—"Specifying and Purchasing," irrespective of whether the book be resorted to by either party interested in the acquisition of castings. Another listing of similar import to the one detailed under "preliminary design" is succinct and to the point. In this chapter there is included a table of specifications covering both grey and nodular irons, and a footnote tells of its availability in the form of a wall card from castings suppliers (American). Additionally, there are printed forms to hand to a customer which, if intelligently filled in, should minimize misunderstandings, especially if accompanied by the "Conditions of Sale"—also printed.

No fewer than 179 pages are devoted to the properties of grey, nodular and white and high-alloy irons. This section is a veritable textbook on the subject and, what is more, it is right up-to-date. Fully to appreciate the various tables and diagrams, British readers should supply themselves with two tables covering temperature and pounds to tons per sq. in. conversions. It is surprising how quickly one learns to appreciate what initially are meaningless figures. In some sections of the book, however, both temperature scales are used. This is especially true when information has been culled from the United Kingdom.

The heat-treatment of cast iron comes in for very detailed consideration and to one phase alone—stress relief, the Editor devotes some 14 pages. The second section of this chapter 6 deals with annealing. American engineers are keen on easy machinability. So also are the textile machine makers in this country and it is germane to remark that in Lancashire it used to be, and may still be, quite normal practice to give castings an overnight annealing while packed in iron ore. This subject of heat-treatment is an enormous one—there are no fewer than 130 references in the book to other literature and whilst there is still much to be learnt, this book has covered the subject extremely well. The balance of the book is given over to such subjects as welding, machinery, abrasing, finishing and metallic and non-metallic coatings for grey iron. The section on vitreous enamelling makes interesting reading, as gossip by visitors to America has left the impression that cast iron as a basic material for treatment by this process was "on its way out." This book certainly does not confirm the gossip but rather the reverse and states that the prospects for increased use of vitreous enamelling on castings are good and should expand.

The reviewer very highly esteems the worth of this book and sincerely recommends its purchase by both the technical and commercial sides of the ironfoundry industry.

V. C. FAULKNER.

Publications Received

Les Veines de la Terre (Veins of the Earth). Issued for private circulation by Le Compagnie de Pont-à-Mousson, France.

Le Compagnie de Pont-à-Mousson, a very large and famous foundry concern mainly concerned with the manufacture of cast-iron pipes, this year celebrates its centenary and has issued a special publication to commemorate the occasion. It is the most luxurious brochure ever inspected by the reviewer and takes the form of double loose-leaves carried between well-designed stiff cardboard backs. There is a manuscript preface written by Jean Cocteau, but the "meat" of the publication is comprised of a dozen symbolic pictures designed and commented upon by Jean Picart le Doux. Under which category of modern art they enter the reviewer does not know, being no art critic. He can say, however, that the seven printings used for each picture have produced a wonderful array of colours and balanced geometrical form.

Polythene Film Wrapping. British Visqueen, Limited, Six Hills Way, Stevenage, Herts—a subsidiary of Imperial Chemical Industries, Limited—has published two catalogues describing and illustrating Visqueen films for enveloping machinery so that it is kept from the effects of moisture during transit. The transparent material makes an excellent cover for fancy goods exposed for sale in shops. In certain circumstances patterns could probably be so packed.

News in Brief

AS FROM MARCH 1, the address of the Midlands office of Wild-Barfield Electric Furnaces, Limited, has been: 71, Broad Street, Birmingham, 15. (Telephone: Midland 7232).

A £17,000 ORDER from its Ontario agents for the supply of 19 2LB two-cylinder 25-h.p. diesel engines has been received by W. H. Dorman & Company, Limited, Stafford.

THE STEELWORKS of Edgar Allen and Company, Limited, Sheffield, were toured by four Japanese trade unionists last month. They afterwards had discussions with shop stewards.

CASELCO, LIMITED, 46, Park Square, Leeds, has been appointed sole selling agent for Yorkshire of Twiflex Couplings, Limited, a subsidiary of Sheepbridge Engineering, Limited.

PLANT FOR PURIFYING ARGON GAS is to be supplied and installed at the Dounreay project of the United Kingdom Atomic Energy Authority by British Oxygen Engineering, Limited.

EXEMPTIONS FROM the first proposed smokeless zone in Oxford will be the log-burning grates in college halls and common rooms, and a smoke house for bacon used by a firm of grocers.

THE SOUTHAMPTON METALLURGICAL SOCIETY of which Dr. O. P. Einerl is the president and Mr. S. W. Hallwood of Folland Aircraft, Limited, Hamble, the honorary secretary, has become an associated society of the Institute of Metals.

THE British Productivity Council, 21, Tothill Street, London, S.W.1, have issued a catalogue of the films they have available dealing with various aspects of productivity. Copies are obtainable on writing to the secretary at 21, Tothill Street.

TWENTY DRIVERS employed by Ruston & Hornsby, Limited, engineers, Lincoln, received second-year safe driving diplomas on February 21. The men drive a variety of vehicles from 15-cwt. to 12-ton articulated lorries, and their annual mileage is 75,000.

WINSTON ELECTRONICS, LIMITED, Shepperton, Middlesex, who decided to enter the South African market 18 months ago, have now received orders totalling £40,000 for telecommunications and electronic equipment from their agent, Mr. R. Hamilton Ross in South Africa.

H.M.S. DUKE OF YORK, one of the capital ships laid up in the Gareloch since 1951, now lies alongside her sister ship Anson in the Faslane yard of Shipbreaking Industries, Limited. The vessel, of 35,000 tons, was built by John Brown & Company, Limited, Clydebank, in 1941.

TWENTY-FOUR MORE IRON WORKERS were paid off at the Smith Patterson, Limited, foundry at Blaydon Haughs on February 21. Three weeks earlier 21 had been paid off. All the latest 24 are skilled or semi-skilled workers. The action is due to a seasonal falling-off in the firm's orders.

THE SIXTH ANNUAL DINNER of the Incorporated Plant Engineers was held at the Connaught Rooms, London, on February 21, and was attended by about 150 members and guests. The principal guest speakers were Sir Cuthbert Clegg, M.A., T.D., J.P. and Major-General C. Lloyd, C.B., C.B.E., T.D., B.SC., F.INST.P.

THE GERMAN CONCERN, W. C. Heraeus, has received an order from William Jessop & Sons, Limited, Sheffield, for a consumable electrode arc-melting furnace. The order was placed through the German company's UK agent, Fleischmann (London), Limited. The furnace, it is stated, will be the largest of its kind in Europe.

SEVENTY BELLS, ranging in weight from a few ounces to more than eight lb., which were found recently in a basket in Horbury Parish Church tower, Yorkshire, have now been sold at a sale of work for over £30. The bells were used over half-a-century ago by the then famous Horbury handbell ringers who won the National Handbell Ringing Championship and made two successful tours in North America.

DAVID BROWN INDUSTRIES, of Huddersfield, have secured an order for 500 gearboxes from one of Britain's leading commercial vehicle manufacturers. In order to obtain this order the company's automobile gearbox division had to design and build prototype gearboxes in the record time of 12 weeks. These have now been successfully tested and bulk production will start at the Huddersfield works in April.

A $220,000 CONTRACT, from the US Army Corps of Engineers, has been placed with the English Electric Export & Trading Company, Limited. Under the contract, a generator transformer, a duplicate of one supplied to the same source in November, 1955, will be manufactured and delivered to the Table Rock power station, White River (Missouri). The generator is of 90, 750/121,000 kva; 13.2/161 kv, three-phase, and 60 cycles.

SPEAKING at the Birmingham College of Technology on February 20, Mr. Eric Southwell, who conducted a detailed investigation into automation at the invitation of the European Productivity Agency last year, said that it would be completely wrong for any section of the community to adopt a form of Luddite attitude towards automation, particularly when it could be valuable to Britain in the event of a European Free Trade area.

AT THE END OF DECEMBER, National Savings groups in the iron, steel, and metal industries and in coal mining in South Wales had a total membership of 74,476, an increase of 392 over the previous quarter. In the former section, membership is now 40,372, or 54 per cent. of the total employed, and in mining there are now 34,104 group savers, an increase of 1,014 on the previous quarterly total. Membership now stands at 31 per cent. of the total employed.

NEW WHITE-METALLING PLANT to be installed at Inverurie railway workshops before mid-summer is expected to result in a considerable increase in production there and in a saving of about 5 per cent. in metal wastage. The plant—for metalling bearings in engine axle-boxes—will replace out-of-date coke furnaces. It consists of four gas-fired white-metalling furnaces and one de-metalling furnace. British Railways have placed a contract for the new plant with a furnace equipment firm in Staffordshire.

IT IS REPORTED that "very encouraging" orders have been received for the General Electric Company's new Supreme cooker, which is now in production at the company's factory at Swinton, near Mexborough. The claim is made that it is the first electric cooker in the world to have an eye-level grill and provision for four hotplates on the hob: the oven has 3,400-cub.-in. capacity. The cooker will be shown to the public at the Ideal Homes Exhibition in London and then will be in the shops.

CROCKETT LOWE, LIMITED, master patternmakers of 3/7, Summer Hill Street, Birmingham, 1, held their twelfth anniversary dinner in the Pavilion Suite, County Grounds, Edgbaston, Birmingham 16. The attendance

News in Brief

was of the order of 250. The chief guest was Mr. William Blackwell, president of the National Union of Manufacturers, Midlands area. Mr. Ralph V. Dowle replied to the toast of "The Guests." The dinner which was followed by dancing was presided over by Mr. William J. Crockett.

TRADE LINKS between Egypt and the British textile machinery industry, interrupted by the Suez crisis, have been re-established. Platt Bros. (Sales), Limited, a subsidiary of Platt Bros. & Company (Holdings), Limited, Oldham, announces that, as a result of negotiations in Cairo at the end of last year, cancelled Egyptian contracts valued at about £1,000,000, have been re-established. The contracts include a wide range of cotton-spinning plant and deliveries are expected to begin in three or four months.

THE MOBILE SCHOOL of the Peterborough diesel engine manufacturing firm of F. Perkins, Limited, is on a 10,000-mile tour of Belgium, Holland, Germany, Austria, Switzerland, and Italy, and will give instruction to about 2,000 people in these countries who are concerned with the sale or handling of Perkins diesels. Last year a similar mobile school toured France and two others are at present on tours of the Argentine and Yugoslavia, respectively. Over 12,000 of the company's engines are being used in the latter country.

CONTINUOUS EFFORTS had been made to impress on industrialists the need to increase the number of apprenticeships, especially in the engineering industry, stated Mr. V. J. Gorner, West Riding County Youth Employment Officer, in his annual report on February 21. He said that there was a dearth of student apprenticeships in the area which meant that local industry would lose some promising young people. The Youth Employment Service had urged industrialists to consider the setting up of group apprenticeship schemes for smaller concerns and to sponsor apprentices for "' sandwich " courses.

THOS. W. WARD, LIMITED, Sheffield, held their annual staff dance at the Cutlers' Hall on February 21. Among those attending were Mr. W. Sampson, director and general manager of Thos. W. Ward (Australia) Pty., Limited; Mr. H. W. Secker, chairman, Thos. W. Ward, Limited; Mr. C. H. T. Williams, managing director of the Park Gate Iron & Steel Company, Limited; Mr. S. Walker, managing director, Laycock Engineering Company, Limited; Mr. George Wood, vice-president of Thos. W. Ward, Limited; Mr. Frank R. Stagg, deputy chairman, and Mr. Arnold Carr, assistant managing director.

MEMBERS of the Midland Civic Heads' Association toured the Soho Foundry of W. & T. Avery, Limited, on February 20. They were received by Mr. Austin Morley, managing director, and by the Mayor of Smethwick, Alderman Arthur Harris. At the conclusion of the visit Councillor R. Griffiths, president of the Association, commented that although Avery products were known all over the world he supposed " no sale has yet been made at the Poles." In point of fact, however, a Soho-made scale is in use with the Trans-Antarctic expedition. It was made and tested in ten days and bears the guarantee that it will work in all conditions.

THE NEW £500,000 EXTENSION to the Heriot-Watt College, Edinburgh, is to be opened on July 3 by the Duke of Edinburgh. The extension will incorporate the new chemical technology department, which will be allied to the chemical engineering department of the college. The extension building, in Chambers Street, will be equipped with a number of physical and chemical laboratories, three lecture theatres, and a number of classrooms and drawing offices. It will also incorporate a memorial hall to the late Dr. Albert Thomson, who was an Honorary Fellow of the College, and a former chairman and managing director of Brown Bros., Limited, London, E.C.2.

WALSALL JOINT RECRUITMENT AND TRAINING SCHEME for the Foundry Industry Committee has called a meeting for March 10 to which representatives of local foundry firms and trade union officials have been invited. The objective of the conference is to consider the inauguration of training schemes for school-leavers. In the opinion of Mr. W. Wilkinson, manager of the Walsall Employment Exchange, it is imperative that local schemes be launched. He said that of nine grammar-school leavers who entered the foundry industry last year, seven had secured positions with foundries outside Walsall because they considered the firms offered them better apprentice training schemes.

AT A MEETING in Birmingham last month of the Midland Regional Board for Industry, Mr. J. W. Eldridge, Regional Controller for the Board of Trade, stated that the total registered as unemployed at the last count in the region was 25,179. There had been an increase to that figure from 21,305 between December and January. He said that there would most probably be an increase of between 2,000 and 2,500 in the overall unemployment figures in the February count, but that was in the normal pattern for February. Mr. S. F. Burman, acting chairman, reviewing the state of trade, said there was no signs of a significant change in overall activity though there were certain pockets where the pattern did not keep to average.

MR. P. J. C. BOVILL, managing director, Newton Chambers & Company, Limited, Thorncliffe, Sheffield, introduced the 19th pre-National Service course of the firm on February 24. There were present 23 apprentices who will be joining the services before July and he told them that nearly 50 per cent. of the apprentices who had been recruited from the firm had received some kind of promotion during their two years' service. The course lasted three days and speakers included Air Vice-Marshal H. V. Satterly, Air Officer Commanding No. 64 (Northern) Group RAF; Brigadier W. W. A. Loring, Schools Liaison Officer, Northern Command; and Mr. W. H. Hammett, the Ministry of Labour's Regional Officer for Military Recruitment.

PRODUCTION IS EXPECTED TO BEGIN in April at the new plant in Scarborough, Ontario, of James Howden & Company, of Canada, Limited, a subsidiary of the Glasgow engineering firm. Located on a 12-acre site about ten miles from the centre of Toronto, the plant will have an initial floor area of 37,000 sq. ft. and will give employment to more than 100 workers in the manufacture of power-station auxiliaries. Key men from Glasgow and London establishments of the firm have gone out to Canada and the necessary cranes and machine tools are on order or have been sent out. According to an official in Glasgow the factory will start off with a fair volume of orders and the prospects are good as demand has switched from hydro to steam power. Howden's also has subsidiary companies in operation in Australia and South Africa.

SAXON ENGINEERING COMPANY, LIMITED—Mr. B. W. Dawkins has been elected chairman of the company and of Bennis Mechanizations, Limited, both of Fenton, Stoke-on-Trent, and subsidiaries of Bennis Combustion, Limited, of which Mr. Dawkins is joint managing director.

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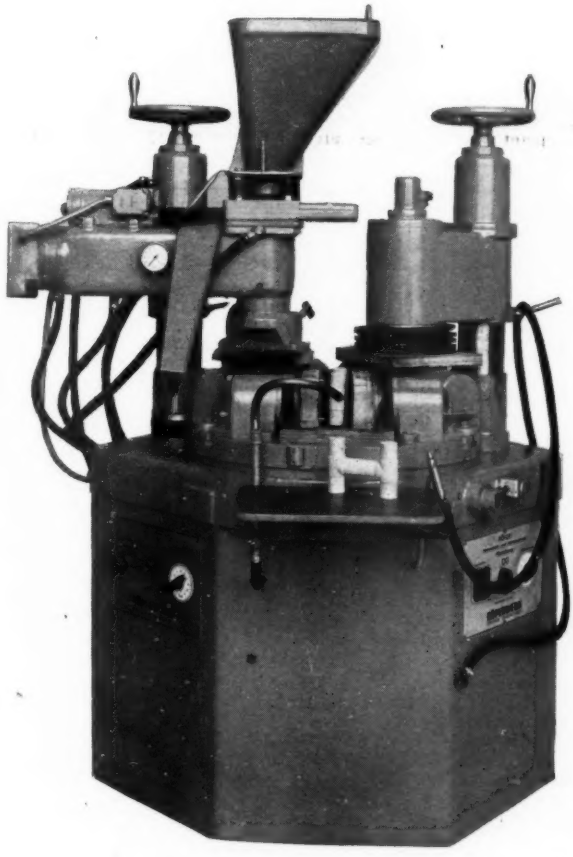

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German Malleable Foundry Producing Pipe-Fitting Core
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Personal

Mr. N. M. PEECH has been appointed a director of Albright and Wilson, Limited.

Mr. D. A. HUBBARD, who joined Aero Research, Limited, in 1939, and has been works manager since 1947, has been appointed a director of the company.

Mr. ROBERT C. BAKER, a director of John Baker & Bessemer, Limited, has been elected president of Sheffield Metallurgical Association in succession to Mr. P. JULICH.

Hardinge Machine Tools, Limited, a subsidiary of Sheepbridge Engineering, Limited, Chesterfield, announce the appointment of Mr. L. L. G. VAUGHAN as sales office manager.

Mr. H. SOUTHERN was appointed by Sheffield University Council, on February 21, as honorary lecturer on furnace design in the Department of Fuel Technology and Chemical Engineering.

Mr. J. B. MCGREGOR has resigned from his post as foundry manager with James Howden & Company, Limited, to take up, from March 1, a post as foundry sales representative in Scotland with F. W. Berk & Company, Limited.

Mr. F. E. HUDSON, a director of Robert Hudson, Limited, light railway engineers, and its associated companies, Leeds, has been appointed a director of the Yorkshire Conservative Newspaper Company, Limited, proprietors of the *Yorkshire Post* and the *Yorkshire Evening Post*.

Mr. J. R. BUNCE has been appointed commercial manager at the Willesden Works of Lancashire Dynamo & Crypto, Limited, with responsibility for the estimating and contracts departments. Mr. Bunce succeeds Mr. W. H. CABLE who is retiring after 37 years with the company.

Mr. DAVID KING, technical Press officer, United Steel Companies, Limited, Sheffield, has been elected chairman of the Northern region of the British Association of Industrial Editors. Mr. ALAN PEAKE of Manchester Oil Refineries, Limited, has been elected vice-chairman of the region.

Mr. DAVID K. PATERSON, who has retired after 36 years with Mitchell, Russell & Company, Limited, ironfounders, Bonnybridge, was for 21 years foreman of the fitting shop. He was presented with a wallet of notes from the firm and staff and a walnut tea-trolley from members of the fitting shop.

Bruce, Peebles & Company, Limited, electrical engineers, Edinburgh, have appointed Mr. SAMUEL A. GASKELL as chairman of the company. A director for more than 10 years, he will take the place of Sir WILLIAM Y. DARLING, who has relinquished the post owing to ill-health; Sir William retains his seat on the board.

At a recent meeting of the Halifax and District Chamber of Commerce, Mr. W. E. ASKE, chairman and managing director of Wm. Aske & Company, Limited, Victoria Works, Waterside, Halifax, was elected junior vice-president. In the normal course of events, he will assume the presidency in 1962; he was elected a member of the Council of the Chamber in 1948.

Mr. T. A. MCKENNA has relinquished his appointment as chairman and director of the Staveley Coal and Iron Company, Limited, and its subsidiaries. In recognition of his valuable services he has been appointed honorary president. Mr. J. P. HUNT succeeds Mr. McKenna as chairman and has relinquished his managing directorship of the company. Mr. M. FROGGATT has been appointed managing director.

Mr. JOHN LANG, Scottish divisional officer of the Iron and Steel Trade Federation, has been appointed chairman of the Scottish Board for Industry by the Chancellor of the Exchequer. Mr. Lang will represent the Board at the meetings of the National Production Advisory Council on Industry. He is a vice-president of the Scottish Council (Development and Industry) and a former chairman of the Scottish TUC.

The Steel Company of Wales, Limited, has announced the appointment of Mr. M. C. HARRISON to be manager of the new Bessemer steel plant which is now under construction at Abbey Works. He assumed his new duties on March 1. Mr. Harrison is an associate of the Institute of Metallurgy and a member of the Iron and Steel Institute. At the same time the company has announced the appointment of Mr. P. TRUSCOTT to be assistant manager of the Bessemer plant.

Mr. H. RONALD HOSKINS, chairman and managing director of Hoskins & Sewell, Limited, ironfounders, Bordesley, Birmingham, celebrated his golden jubilee at the foundry at a luncheon last week. Mr. Hoskins, a grandson of Mr. Ebenezer Collins who founded the firm of bedstead makers, was appointed a director in 1924, and chairman in 1936. At the luncheon he was presented with a television set by Mr. J. H. HARVEY, deputy chairman, who has been joint managing director for 22 years.

Mr. F. H. LAWDER, chief labour superintendent of the United Steel Companies, Limited, has been elected president of the Iron and Steel Trades Employers' Association. He succeeds Mr. W. F. GILBERTSON, of Richard Thomas & Baldwins, Limited. Mr. Lawder joined United Steel in 1946 and was subsequently appointed general manager of the Ministry of Supply Monkbridge works and then general manager of the Ministry of Supply Barrow Steel Works before being appointed chief labour superintendent of United Steel in 1951.

Obituary

ROGER SORTON DARBY

Mr. Roger Sorton Darby, who had been associated with the metal merchants firm of Darby & Company (Birmingham), Limited, since 1914, and was a director, died on February 27 at the age of 64. He was a Liveryman of the Worshipful Company of Founders and a guardian and warden of the Birmingham Assay Office. He had been a Justice of the Peace for Birmingham since 1943. Mr. Darby was born at Edgbaston and was educated at Bootham School and Lausanne. From 1923 to 1946 he served on the governing committee of the Bootham and Mount Schools and from 1940 to 1952 on the Birmingham Education Committee. He was also a trustee of the William Dudley Trust, and in 1952, a member of the Council of Birmingham Chamber of Commerce.

Mr. JAMES L. MOUNSEY, for many years voting partner and member of the standing committee of the Carron Company, ironfounders, Falkirk, died last week after a short illness. In 1948 he was appointed the company's secretary, a position he held until the end of last year.

These men may be changing your life

Scientific journalist J. Stubbs Walker reports from Sheffield on work that could prepare for space travel— or change your shaving habits. Picture by Ivor Sharp.

TRASH OR TREASURE? Between finger and thumb, a white-coated laboratory assistant holds a grey and grubby lump no bigger than a hazel nut.

It may be valueless. It may be worth an industrial fortune. Almost certainly it is unique – a new kind of steel.

If it is trash the steel men will soon know. In the laboratories here in Sheffield (the home of very special steels for very special jobs) they will stretch it, squeeze it, heat it, freeze it, twist and tear it, soak it in fuming corrosives. To prove that the grubby grey lump really *is* treasure may take longer. Sometimes years.

But whatever the tests prove, the steel men (a proud and individual race) consider it worth while. It "improves the breed" of steel. The hazel nut of experimentation could make it possible to build more powerful rockets, faster aeroplanes or – who knows? – space-travelling moons. Or it could alter the shaving habits of the world by enabling more bristles to be cut with every blade!

SMALL ORDERS MATTER JUST AS MUCH

Steel is essential for the speeds of tomorrow because conventional aircraft metals soften and crumble as they reach the heat barrier. Aircraft of the immediate future will be all steel – *special* steel. Thanks to the white-coated laboratory men and the sweating experts at the furnace, Sheffield has the metal now.

The striking thing in the steel business is the trouble everyone takes. One Sheffield firm produces 500 different specifications of metal. They have been making some of the world's toughest tool steel for a hundred years. Yet the tapping of a furnace is still an Event.

Each customer is an individual, even though his regular order is for only half-a-hundredweight of "difficult" metal twice a year.

THE ROOM WHERE NO CLEANER IS ALLOWED

The steel men achieve their advances in surprising ways. You may think of steel being tempered by heat; but the laboratories of United Steel are working on a stainless alloy that doubles its tensile strength by being frozen to *minus* 70 degrees C.

The steel laboratories are among the most advanced in Industry. Every new metal must be tested in a dozen ways. Most important is the amount of "creep" or deformation of the metal under load. It calls for tests which may go on literally for years.

Rows of creep-testing instruments are housed in a room where no cleaner is ever allowed. Delicate halfpenny-sized mirrors reflect light beams to measure changes in length in the metal as small as two-millionths of an inch. The careless flick of a duster could disturb the mirrors and ruin a year's work.

The endless roar of the rolling mills, the brain-jerking shock of multi-ton hammers all suggest an industry of brawny violence. But behind it there is a refined understanding of the meaning of milligrams, of the precise control of temperatures. Sheffield has always taken trouble over its steel.

This report was commissioned by the British Iron and Steel Federation, which believes that everyone should know the facts about steel, and the men making it.

Scientists at the Swinden Laboratories of United Steel study the behaviour of air currents in a perspex model of a furnace.

Raw Material Markets

Iron and Steel

With the possible exception of the low-phosphorus irons, there is no scarcity of supplies of any grade of foundry pig-iron. Increased outputs of the low-phosphorus irons are, however, now filling the gap and replacing the more expensive hematite and refined irons which consumers have been compelled to use.

Outputs of pig-iron at the blast furnaces are maintained at high levels and adequate supplies of raw materials ensure continuity of production. Stocks of ore are at good levels and regular deliveries are being made to fulfil consumption and stock requirements. With more than three quarters of current output in basic pig-iron going to the steelworks, they are adequately supplied and there are no supply difficulties so far as hematite pig-iron and refined irons are concerned.

Production of high-phosphorus pig-iron is much greater than home needs, and tonnages in stock enable makers to undertake overseas business. Consignments of hematite and refined irons are also being shipped abroad.

The engineering and speciality foundries are generally well employed, particularly those catering for the motor vehicle trade. The machine-tool foundries are not so busy as they were. Some seasonal improvement may be expected shortly in builders' castings to give much-needed extra work for the light foundries. More orders are also required by the textile foundries, and many of the jobbing foundries.

Buying of raw materials by the foundries continues cautious; stocks are kept to a minimum and forward business is negligible. The supply position of most grades and analyses of pig-iron is so easy that prompt delivery from stock can be made by the furnaces, and the present economic position and the uncertainty of the future does not warrant the carrying of more stock by the foundries than is essential to ensure a continuity of production.

Demand for scrap is steady, and arisings of the better and heavier grades of cast-iron scrap are absorbed. Foundry coke is supplied in sufficient quantities to satisfy requirements.

In most areas the re-rollers report a shortage of orders for small bars and light sections, resulting in a reduced number of working shifts at many establishments. Difficulty is experienced in making up rolling programmes for the individual sizes, and fresh business is promptly undertaken. The call for the heavier sections and bars, also reinforcing rods, is on a better scale, but not so heavy as it was a few weeks ago.

The supply of steel semis continues easy and the steelworks find it difficult to dispose of all of their output. The shortage of orders for finished products has not used up the stocks of billets on hand at the re-rollers as fast as expected, and, in common with other consumers of raw materials, minimum stocks are being carried. The re-rollers show little inclination to take up the appreciable quantities of defectives and crops which continue to arise at the steelworks, and are not likely to do so until the prices of this material are sufficiently attractive to enable it to be used economically.

Non-ferrous Metals

The reduction in the price quoted by the US custom smelters to 23 cents a pound late last week has not only unhinged the price structure in other world copper markets but also must exert well-nigh intolerable pressure on the US producers to bring their quotation down from its present level of 25 cents a pound.

The US producers are batting on a sticky wicket. At present their price is 25 cents a pound, that is to say, 2 cents a pound higher than the custom smelter price which by any normal standards of reckoning represents too big a gap to be maintained. But if they lower their price the average monthly US copper price will go below 24 cents a pound and thus attract a duty of 2 cents per pound. Of the "big three" US copper producers—Phelps Dodge, Kennecott, and Anaconda—the last two named have large foreign interests. Since the duty would fall heavily on foreign producers neither Kennecott nor Anaconda are eager to drop their price. Phelps Dodge, the only wholly domestic producer, does not have this worry, but, on the other hand, the company is not keen to take the initiative of lowering the price, which would alienate the smaller US producers. Nevertheless, it must be only a matter of time before the producer price is dropped.

Pressure to do so is therefore strong and is made the stronger by the fact that the custom smelters are now transacting about half the total business. Meanwhile, the scrap price has been lowered ¼ cent to 17¼ cents a pound, which underlines the weakness of the US market.

In London the settlement price on Friday, reflecting desultory trading conditions, was down to £160 10s. a ton, which is the lowest point raeched in four and a half years. However, general business activity in Europe for copper is satisfactory. In fact, it is a moot point whether there is or is not a shortage of electrolytic copper. At present the red metal is flowing across the Atlantic to the USA, so that if there is a shortage of electrolytic copper and it is suddenly reflected in day-to-day demand, the London price would have to soar several cents a pound to attract metal from the other side. Elsewhere it is of some interest to note that the continued depression in the copper price has resulted in the closing down of Rainville Mines, the Quebec copper producer, and the Britannia Copper Mines in British Columbia.

The Eastern price for tin continues to fluctuate wildly, which is being attributed to the varying pressures exerted on the supply position for Straits tin. The recent tendency for the fall to be greater than the rise can, however, be traced to the necessity for the Malayan tin producers to increase their contribution to the Buffer stock pool by $M9.00 to $M21.00 a picul.

In London the market is steady and the view is still firmly held that the price will advance steadily so soon as the quota restrictions make themselves felt. Although stocks of tin have been increasing in LME warehouses, this has not been due to any act of the buffer stock manager, as the price has been above the support price of £730 a ton. In the United States, where demand is virtually non-existent, the price has dropped below 95 cents a pound.

Lead is quietly steady in London and quiet in New York, where the price is holding at 13 cents a pound. Zinc is quiet to weak on both sides of the Atlantic, although there is some evidence coming forward that cutbacks in production are beginning to make themselves felt, with the result that it is not thought that the London price will go much lower. In the US the price is called 10 cents a pound.

THE BRITISH TRANSPORT COMMISSION announce that a contract has been placed with Chas. Roberts & Company, Limited, Horbury Junction, Wakefield, for 90, 24-ton covered hopper wagons, in connection with the British Railways Modernization programme.

The successful application of fabric reinforced grinding and cut-off wheels depends on their use with the right type of grinder. This means a grinder which provides the correct combination of power and speed to suit the wheel and the job. Operating at up to 16,000 surface ft./min. with practically constant speed at all loads, and having four times the power reserve of size-for-size machines, Hicycle grinders ensure that fullest advantage is taken of the outstanding performance potential of dished hub and cut-off wheels. Write for the Hicycle catalogue No. 54C.

UP TO 16,000 FEET PER MINUTE CUTTING SPEED!

WHAT IS HYCYCLE? A range of electric tools for increasing the output per man by stepping up the electricity supply to 200 cycles, thus providing a high, maintained working speed. Other advantages are: greater reliability because there are no armature windings to burn out, greater power with no increase in weight, and absolute safety because of only 72 volts to earth. If you use six or more portable electric tools, you can definitely increase production and reduce maintenance by installing Hicycle.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

March 5, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £48 10s. 0d. to £50 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £68 10s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 26s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £93 0s. 0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 32s. 0d. per unit; over 6 per cent. C, £91 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3d. to 7s. 10½d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 20s. 9d. to 21s. 3d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles (N.-E. Coast), £40 6s. 6d.; joists (N.-E. Coast), £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24g., £59 4s. 6d.; galvanized corrugated sheets, 24g., £67 6s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d.; nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £162 10s. 0d. to £162 15s. 0d.; three months, £164 10s. 0d. to £164 15s. 0d.; settlement, £162 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 7½d. per lb. rods, 184s. 6d. per cwt. basis; 20 s.w.g., 217s. 9d. per cwt.

Tin.—Cash, £731 0s. 0d. to £732 0s. 0d.; three months, £738 0s. 0d. to £739 0s. 0d.; settlement, £732 0s. 0d.

Lead (Refined Pig).—First half March, £74 15s. 0d. to £74 17s. 6d.; first half June, £74 7s. 6d. to £74 10s. 0d.

Zinc.—First half March, £63 10s. 0d. to £63 12s. 6d.; first half June, £63 5s. 0d. to £63 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £96 15s. 0d.; rolled zinc (boiler plates), all English destinations, £94 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £87 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 4⅛d. per lb.; sheets to 10 w.g., 143s. 0d. per cwt.; wire, 2s. 1⅞d.; rolled metal, 143s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £124; B6 (85/15), £163; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £162; HTB2 (38 tons), — ; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £149; LG3 (86/7/5/2), £161; G1 (88/10/2/½), £210; (88/10/2/1), £203.

Phosphor Bronze.—BS1400, PB1 (AID released), £230 per ton.

Phosphor Bronze Strip, etc.—Strip, 213s. 6d. per cwt.; wire, 3s. 4½d. per lb.; rods, 2s. 8d.; tubes, 2s. 8d.; chill cast bars: solids 2s. 10½d.; cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 3¾d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 8½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 7½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £77 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, — ; AB2, — .

* Average 68-70 per cent.

Forthcoming Events

MARCH 10

North-East Metallurgical Society

"Recent Advances in Metallography," by D. McLean, D.Sc., 7.15 p.m., at the Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.

East Midlands Metallurgical Society

"Continuous Casting of Steel," 7.30 p.m., at the College of Art, Green Lane, Derby.

MARCH 11

Institute of British Foundrymen

Coventry and district section:—"Moulding with the CO_2 Process in a Jobbing Foundry," by J. Hird, 7.30 p.m., at the Coventry Technical College, Room A.5.

MARCH 12

Institute of British Foundrymen

Southampton section:—"Fifty Years of Art Founding," by A. L. Parrott, 7.30 p.m., at the Technical College, St. Mary's Street.

West Riding of Yorkshire branch:—"Wear Resistance of Cast Iron," by Dr. H. T. Angus, 7.30 p.m., at the Bradford Institute of Technology.

Institution of Production Engineers

London graduate section:—Works visit to R. A. Lister & Company, Limited, mainly concerned with aspects of the manufacture of diesel engines. (Details from the secretary.)

National Society of Master Patternmakers

Visit to the Margam works of the Steel Company of Wales, Limited. Buffet luncheon, 11.45 a.m. for 12 noon, at the Angel Hotel, Cardiff; depart from hotel 1 p.m. to arrive at the main entrance to the Abbey Works, Port Talbot, 2.15 p.m.; tea at end of visit at approximately 4.30 p.m. Dinner at Angel Hotel, 7 p.m.

MARCH 13

Plastics Institute

Ninth annual lecture: "Plastics in Conveyor Belting," by C. G. Addingley, 6.30 p.m., in the large Chemistry Hall, Leeds University.

Institute of British Foundrymen

Lincolnshire branch:—"S.G. Iron—a Versatile Engineering Metal," by W. W. Braidwood, 7.15 p.m., at the Technical College, Lincoln.

MARCH 14

Institute of British Foundrymen

Beds/Herts section:—Visit to the works of Foundry Equipment, Limited, Leighton Buzzard, Beds. (Details from the secretary.)

Bristol and West of England branch:—"Modern Developments in Light-alloy Practice," by R. H. Fellows, 7.30 p.m., at the Grand Hotel, Bristol.

Tees-side branch:—Smoking concert and "Any Questions," 7.30 p.m., at the Teesdale Hall of Head Wrightson & Company, Limited, Thornaby.

Institution of Production Engineers

Ipswich and Colchester section:—"Work Study," by Rear Admiral R. S. Warne, 7.30 p.m., at the Britannia Works canteen, Davey Paxman & Company, Limited, Colchester.

MARCH 15

Institute of British Foundrymen

Northampton and district section:—Works visit to Baker Perkins, Limited, Peterborough, 10 a.m.

Institution of Production Engineers

Luton graduate section:—Visit to George Kent, Limited, Biscot Works, Luton. (Details from the secretary.)

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Pig-iron and Steel Production

Statistical Summary of December Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during recent months. Table II gives production of steel ingots and castings in December and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in December, and furnaces in blast. (All figures are weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938=100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	Basic materials excl. fuel [1]						Imports.[2]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[3]
1955	276	399	529	311	244	246	240	213	29	381	305	1,247
1956	295	454	542	312	272	264	253	216	27	397	318	1,444
1957—Aug. ..	341	502	535	299	313	267	272	190	13	373	270	1,673
Sept. ..	342	501	525	326	313	271	283	233	13	438	339	1,635
Oct.[4]	343	497	516	330	322	274	285	232	10	438	340	1,574
Nov. ..	342	511	508	317	319	273	282	229	16	429	359	1,492
Dec. ..	342	512	501	276	313	265	276	206	13	398	—	1,445

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in December, 1957*

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants, and Essex ..	—	5.7	9.0 (basic)	2.4	0.1	15.9	1.3	17.2
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.8	31.1	—	2.2	0.4	34.1	1.4	35.5
Yorks. (excl. N.E. Coast and Sheffield)								
Lincs.	—	46.4	—	—	0.1	46.4	0.1	46.5
North-East Coast	0.5	87.0	—	1.3	0.5	87.4	1.9	89.3
Scotland	2.6	44.9	—	2.9	0.2	48.1	2.5	50.6
Staffs., Salop., Worcs., and Warwick	—	17.7	—	1.0	0.7	17.9	1.5	19.4
S. Wales and Mon.	3.1	73.0	7.1 (basic)	1.1	0.2	83.9	0.6	84.5
Sheffield (incl. small tonnage in Manchester) ..	8.6	29.1	—	10.6	0.4	46.8	1.9	48.7
North-West Coast	0.1	0.9	4.6 (acid)	0.5	0.1	6.0	0.2	6.2
Total	16.7	335.8	20.7	22.0	2.7	386.5	11.4	397.9
November, 1957	18.7	358.3	23.8	25.4	3.0	416.1	13.1	429.2
December, 1956	16.3	329.6	25.2	22.1	2.7	384.6	11.3	395.9

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1955.	1956.	1956.	1957.	
			Nov.	Oct.[5]	Nov.
Non-alloy steel:					
Ingots, blooms, billets and slabs [5]	4.9	4.7	4.7	5.2	6.2
Heavy rails ..	9.4	9.7	11.3	11.5	11.8
Sleepers, etc. ..	2.0	1.8	2.0	2.1	2.0
Plates, 3mm. and over	46.1	50.2	57.5	55.8	59.5
Other heavy prod.	47.8	50.3	54.6	57.1	57.5
Ferro-con. bars, etc.	7.0	7.8	9.0	8.9	10.8
Wire rods	22.2	22.9	24.8	26.3	27.4
Arches, etc. ..	9.6	10.1	11.5	11.2	12.2
Other light sections	36.8	41.4	45.3	40.0	41.2
Bright steel bars ..	7.8	8.0	8.3	7.1	7.7
Hot-rolled strip ..	24.1	24.5	24.5	24.6	26.7
Cold-rolled strip ..	8.1	7.5	6.8	7.8	8.8
Sheets incl. coated:					
(i) Hot rolled ..	16.6	15.0	14.9	13.4	14.6
(ii) Cold reduced	26.1	24.8	28.4	32.2	32.6
Tin- and terneplate	15.6	15.9	18.7	18.3	17.6
Blackplate ..	1.4	1.3	1.0	1.1	1.2
Steel tubes, pipes	22.9	26.2	30.0	26.0	27.1
Tube, pipe fittings	0.4	0.5	0.5	0.4	0.5
Tyres, wheels, axles	4.8	4.6	4.7	6.2	5.7
Forgings (excl. drop forgings) ..	2.5	3.0	3.5	3.1	3.5
Steel castings ..	4.2	4.5	5.0	5.2	5.2
Tool and magnet steel	0.3	0.3	0.3	0.3	0.3
Total	320.6	335.0	367.3	363.8	380.1
Alloy steel	15.8	17.3	18.8	18.9	20.7
Total deliveries from U.K. prod. [6] ..	336.4	352.3	386.1	382.7	400.8
Add: Imported finished steel ..	18.9	19.5	11.9	10.7	15.1
	855.3	371.8	398.0	393.4	415.9
Deduct: Intra-industry conversion[7] ..	50.9	55.2	57.5	54.1	57.7
Total new material ..	304.4	316.6	340.5	339.3	358.2

TABLE IV.—*Production of Pig-iron and Ferro-alloys during December, 1957*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derbys., Leics., Notts., Northants, and Essex	22	—	19.7	20.2	1.1	—	41.0
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	7	—	19.1	—	—	1.6	20.7
Yorks. (excl. N.E. Coast and Sheffield)	—	—	—	—	—	—	—
Lincs.	10	—	42.7	—	—	—	42.7
North-East Coast	21	4.4	59.8	—	—	1.5	65.7
Scotland	9	0.9	22.1	1.8	—	—	24.8
Staffs., Salop., Worcs., and Warwick ..	6	—	7.3	1.4	—	—	8.7
S. Wales and Monmouthshire	11	4.6	44.6	—	—	—	49.2
Sheffield	2	—	3.2	—	—	—	3.2
North-West Coast	8	18.1	—	0.2	—	1.2	19.5
Total ..	96	28.0	218.5	23.6	1.1	4.3	275.5
November, 1957	98	30.2	220.2	26.2	0.7	4.2	281.5
December, 1956	100	30.1	201.2	27.0	1.3	2.7	262.3

[1] Used in non-food-manufacturing industry.
[2] Weekly average of calendar month.
[3] Stocks, mainly ingots and semi-finished, at the end of the years and months shown.
[4] Five weeks, all tables.
[5] Other than for conversion into any other form of finished steel listed.
[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
[7] Material for conversion into other products also listed in this table.